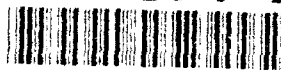


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THE BUFFALO CREEK ARCHAEOLOGICAL PROJECT

VOLUME 1:

BACKGROUND AND TESTING AT 3MS346 AND 3CG847
MISSISSIPPI AND CRAIGHEAD COUNTIES, ARKANSAS

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PROFESSIONAL SERVICE INDUSTRIES, INC.

1992

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THE BUFFALO CREEK
ARCHAEOLOGICAL PROJECT

VOLUME I:
BACKGROUND AND TESTING AT 3MS346 AND 3CG847
MISSISSIPPI AND CRAIGHEAD COUNTIES, ARKANSAS

Paul E. Brockington, Jr.
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Soil Systems, Inc.
Professional Service Industries, Inc.

1992

Prepared Under Contract No. DACW66-81-C-0082
For the Memphis District, Corps of Engineers

ABSTRACT

This report describes archaeological test and data recovery excavations at three prehistoric sites in Mississippi and Craighead Counties in northeast Arkansas sponsored by the Memphis District, Corps of Engineers. Archaeological site studies were carried out in advance of construction of the Buffalo Creek Diversion Canal and were designed to provide detailed evaluation of the sites' data content and to develop data recovery plans as necessary.

Field research was carried out in the summer of 1981, with laboratory analysis and report preparation in 1981, 1982, and early 1983. All work was funded by the Memphis District, Corps of Engineers, under a contract agreement between the District and Soil Systems, Inc. Over five hundred one meter square test pits were excavated at the three sites, along with testing by backhoe. Two of the sites, 3MS346, and 3CG847, were recommended to have little further scientific study potential. The third site, 3MS351, was recommended as containing additional significant archaeological deposits. Further work beyond the testing phase was recommended for 3MS351 and was accomplished under modification of the agreement for testing.

All three sites contained evidence of occupation during the Woodland and Mississippian prehistoric periods. Site 3MS351 also contained artifacts dating to the preceding Archaic period. The test excavations are described in Volume I of this report; also present are discussions of the environmental and cultural setting of the project area and a review of previous research in the region.

Sites 3MS346 and 3CG847 were found to contain small Late Woodland period Dunklin (Barnes) Phase components. Site 3MS346 also contained an Early Mississippian period, Big Lake phase component. At 3CG847, Early Mississippian period material recovered included one point and less than a dozen ceramic fragments. Although initial survey data had indicated strong research potential for both these sites, the 1981 field work indicated extensive destruction of deposits at both sites. This appeared to be due primarily to wind erosion of the dune deposits forming the site matrices. This wind erosion resulted in deflation and mixing of artifacts from different occupations, and, most probably, destruction of features that may have been present at the site.

Site 3MS351 was originally reported from survey information as small, with less of a probability than 3MS346 and 3CG847 of producing significant data. However, the 1981 testing revealed that it was a large site with a long occupation history. Deposits of over a meter were relatively well preserved. These deposits included Dalton, several Archaic groups, Late Woodland, and Early Mississippian. After an extensive period of testing, several large data recovery blocks were excavated at 3MS351 in an attempt to uncover houses and other occupation - related structures. Excavations revealed that the site represented a series of small occupations along the edge of a braided stream. The central portion of the site appears to be a levee of that relict stream. Although no structural features were found (no house - post patterns or defined trash pits), the site deposits were not thoroughly mixed as at 3MS346 and 3CG847. Broad patterns of artifact superposition were present, and several artifact clusters were discovered. The lack of well defined features was thought to be due to leaching of organic materials through the porous, sandy soils of the site matrix. Also late prehistoric deposits may have been impacted by agricultural leveling of the relict levee area and by an historic occupation at the site.

The Dalton, Archaic, Woodland, and Mississippi components at 3MS351 would appear to represent small, short term camps, because of the paucity of artifacts present, especially the lack of lithics and the lack of definable activity areas. That conclusion, however, is questioned for these occupations, and a model involving the cost of lithic procurement in this area and its effects on archaeological assemblages is presented. It is hypothesized that lithic material is expensive to procure in this area of Arkansas, and this would result in careful artifact curation, reuse, and a quite different archaeological assemblage than would be expected where lithic material was easily procured.

Data recovery field methods and study results at 3MS351 are presented in Volume II of this report.

ACKNOWLEDGEMENTS

A large, complex field, laboratory, and reporting project like the Buffalo Creek Diversion Archaeological Project involves an extensive cast. First, we would like to thank the staff of the Memphis District, Corps of Engineers for their cooperation and assistance with all the inevitable but individually unexpected "glitches" that arose during the project. Mr. Doug Prescott and Mr. Jim McNeil of the Memphis District monitored our field work and provided their experience and expertise to solve problems and to suggest new approaches. Ms. Hester Davis and her staff at the Arkansas State Archaeologist's office cooperated freely with us in developing standardized recordation forms and preparing the artifacts for curation. The people of Leachville, Arkansas were universally friendly and helpful to a large group of "outsiders."

We especially thank the many individuals who worked with the project during its laboratory and field phases. A roster of project employees is presented as Appendix B. It is important to note that while report authors' names are noted and remembered (sometimes), each individual associated with the project has contributed, from the water screeners to the word processors, from the computer analyst to the backhoe operator.

Authors of the report were A. Merrill Dicks, Wayne P. Glander, and Paul E. Brockington, Jr. The report Summary Table of Contents lists authors with chapters for which they were responsible. Paul Brockington edited the entire report.

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CHAPTER 1

INTRODUCTION

In the summer of 1981, Soil Systems, Inc. was contracted to provide archaeological services for the Corps of Engineers, Memphis District, by testing three sites in northeastern Arkansas that were to be impacted by the construction of the Buffalo Creek Diversion Canal (Fig. 1-1). The purpose of the testing at these sites was to provide a more detailed assessment of each in terms of its potential for data recovery and to develop detailed data recovery plans as necessary. Preliminary site information was provided by Iroquois Research Institute, which had conducted the initial reconnaissance for sites along the proposed drainage ditch right-of-way. Based on this information and the Arkansas State Plan for Archaeology, a testing strategy and research design were developed.

Field work on the Buffalo Creek Archaeological Project was initiated July 6, 1981 with a crew of 40 individuals and a supervisory staff of five. Phase I testing was concluded on July 31, 1981 and was followed by an interim period of ten days during which an evaluation of the testing was performed. The conclusion of the testing phase were that two of the three sites, the Jackson site (3MS346) and the Turkey Run site (3CG847) would not yield additional significant data beyond what had already been recovered. No further work was recommended for these sites. The Steele site (3MS351), however, was judged to contain additional significant desposits, and a phase of extensive excavation was recommended. Phase II work at the Steele site began August 10, 1981 with a field crew of 24 and ended October 19, 1981. The results of the Phase I testing program at 3MS346 and 3CG847 are presented in Volume I of this report, along with environmental and cultural background of the area and the project research design. Volume II of this report describes Phase I testing and the Phase II data recovery excavations at the Steele site (3MS351) and summarizes knowledge gained by the project.

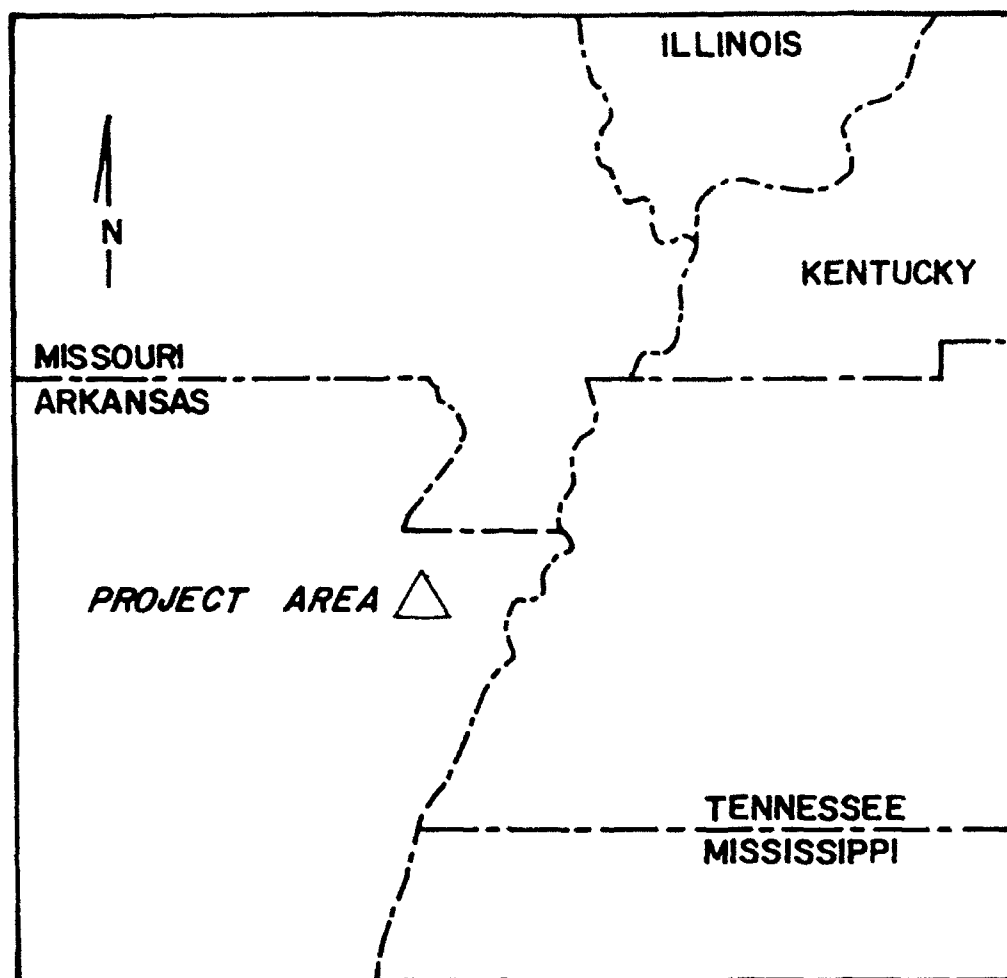


Figure 1-1. Location of the Buffalo Creek Diversion project area in northeast Arkansas.

CHAPTER 2 PREVIOUS STUDY IN THE PROJECT REGION

Previous Investigations

The history of archaeological studies in northeast Arkansas can be dated as far back as the latter part of the nineteenth century. Many of these early studies reflect early religious attitudes and not a study of the past for its own sake. Such studies were, in fact, a part of a large uncoordinated effort to identify the numerous and often perplexing mounds known to exist in the Central and Lower Mississippi Valley. It was not until the first quarter of the twentieth century that a more "scientific" approach began to be instituted.

The history of early exploration and investigation of archaeology in the Central and Lower Mississippi Valley can be divided into three periods. These periods are:

- (1) Antiquarian Period (1820-1935)
- (2) Cultural Historical Period (1936-1973)
- (3) Cultural Ecological Period (1974-Present)

The development of archaeological research within northeast Arkansas is briefly outlined below within the framework of these three periods.

The Antiquarian Period (1820-1935)

The Antiquarian Period was dominated by the early religious myths concerning mound sites in the eastern United States, and a desire to acquire the objects frequently associated with mound sites. The Mississippi and Ohio River Valleys were the scene of much of this early activity (Atwater 1820; Squier and Davis, 1848; Squier 1860; Evers 1880; Short 1880; Holmes 1886). The better of these early investigations published reports of their undertakings and exhibited the artifacts recovered. Although most of their notes, photographs, and artifacts are now lost, these investigations certainly stimulated public thinking and the interest of professionals.

Holmes (1886) presents one of the earliest accounts dealing with Arkansas. His work was early in the development of the Bureau of Ethnology, Smithsonian Institution, and dealt in part with ceramics from Arkansas. Probably some of the earliest research conducted in the St. Francis Basin was directed by Cyrus Thomas (1894), also of the Smithsonian Institution. Thomas recorded and described several sites in the St. Francis Basin area as part of a project for which he gathered information over much of the eastern United States. Based on his collected data, Thomas argued strongly that the mound sites scattered across the country were built by North American Indians and their ancestors, and not by a now-vanished race of advanced peoples.

The work of Thomas was followed by another volume by Holmes (1903). This was a synthesis of eastern United States ceramics to that time and represents one of the first attempts at classification and analysis of aboriginal ceramics. Holmes (1903) study in ways was the basis for modern ceramic and cultural historical studies to follow and greatly influences later work.

One of the more significant studies for the St. Francis Basin area was that conducted by C. B. Moore (1910). Basically an adventurer, Moore steamed up and down the major river valleys of the Southeast recording and excavating mounds along the way (Moore 1908, 1911, 1912). Moore's publications describing mound sites, burials, and ceramic vessels recovered were excellent for the time. They stimulated scientific thinking and added greatly to the accumulating body of information available for scholars.

The Cultural Historical Period (1936-1973)

This period saw a change in emphasis when studying the mound groups of the Valley. With the increase in data available, attention was toward the understanding of chronological relationships among sites. Movement in this direction was somewhat anticipated in the preceeding period by Holmes (1903) and by the increasing numbers of archaeologists in the third and fourth decades of the twentieth century, but the change can best be seen in a major study, by Ford in 1936. In that year Ford presented the results of a survey conducted in Louisiana and Mississippi in which he assigned sites to culture periods and complexes. Based in part upon his own previous work and the work of others, Ford defined a cultural sequence consisting of the Marksville period followed by the Deasonville and Coles Creek complexes. This was followed by the work of Ford and Willey (1940) in Louisiana. They added three more periods to those discussed by Ford: Tchefuncte, Troyville, and Plaquemine.

The significance of these works is that by the 1940s the general outline of cultural chronology had been worked out for the Lower Mississippi Valley. The sequences would be revised and updated (Williams 1954; Phillips 1970), but archaeologists in the Valley now had a data base against which their own sites could be compared.

A major survey effort in the Lower Mississippi Valley, including the Eastern Lowlands south of Marked Tree, Arkansas, was undertaken in the 1940s by Phillips, Ford and Griffin. Results of this massive effort were published in 1951 and still remain a basic source for Arkansas prehistory and the Lower Valley in general.

During the cultural historical period, work in Arkansas was proceeding principally in the southwestern part of the state, the Ozarks, and in the larger mound sites in northeast Arkansas. In northeast Arkansas the Hazel site was initially tested in 1933 by the University of Arkansas Museum. Dellinger and Dickinson (1940) reported on work done on sites in Crittenden, Poinsett, and Mississippi counties.

This was followed by an increase in excavation activities in the 1950s and 1960s in the St. Francis Basin area. In the Missouri portion of the Basin Williams (1954) produced his study of Mississippian occupation which also included data on earlier cultural periods. In northeast Arkansas, Moselage (1962) published results of the Lawhorn excavations. This was followed by the work at Helena Crossing (Ford 1964), the Banks and Cherry Valley site data (Perino 1966, 1967), and excavation on the Parkin site (Davis 1966).

The next major survey was accomplished by the team of Ford and Redfield in 1961-1962. The survey was conducted to locate evidence of early occupation in the Lower Mississippi Valley, and this study was one of the first to fully document the presence of Paleo-Indian and Archaic occupations in Arkansas.

The 1960s saw interest in defining and developing several Mississippi phases in northeast Arkansas. Moselage excavated at the Lawhorn site (1962) and Perino (1967) excavated at the Cherry Valley Mounds. The Parkin site was tested by the Arkansas Archeological Society in 1965. The Modena site, tested since the 1930s, was also worked in this decade (Morse 1973). After the establishment of the Arkansas Archeological Survey in 1967, Morse (1968) studied part of the Big Lake Wildlife Refuge in advance of pending efforts to widen a drainage channel there. As a result, the Zebree site was recommended for further work (Morse 1969). Excavations were carried out in 1968, 1969, 1975, 1975, and 1979. The Zebree site was found to be a stratified Late Woodland/Early Mississippi site containing information relative to the development of the Mississippi period in northeast Arkansas.

One of the most significant works applicable to the entire Lower Mississippi Valley was accomplished by Phillips (1970). The report was originally intended as a companion volume for Phillips, Ford, and Griffin (1951). Phillips' work can still be considered principally cultural historical, even though Fisk's geological data (1944) played a role in Phillips' data analysis.

Phillips redefined virtually all the Lower Mississippi Valley ceramics in the type-variety system of nomenclature. Using this system he was able to recognize new phases throughout the valley. He produced a chronological scheme with major periods which are not geographically restricted or bounded temporally, and lesser phases which are bounded both temporally and spatially.

The Cultural Ecological Period (1974 to present)

The Cultural Ecological Period is based upon a theoretical change in archaeology emphasizing human ecological relationships and evolutionary processes acting within the ecological system. Man-land relationships, settlement patterns, and intra-site activity areas have become the focus of an orientation emphasizing the functional, adaptive relationship of human groups to their environment. It is reasonable to assume that this orientation could not proceed without first having a well established chronology on which to rely. Chronologies are, of course, not presently ignored, as considerable refinement is necessary for evolutionary and economic analysis. Such chronological problems are now more limited to phase definition than the broad period problems tackled by Ford and others earlier this century.

The date selected for the initiation of this period is the publication of Saucier (1974). This was a major attempt to remove the Fiskian geologic chronologies from the archaeological record so that archaeological components could be better associated with hypothesized past environment (see Chapter 4 below). Saucier was not the first, of course, to work with this concept. Willey (1953), McIntire (1958), Fitting (1969), Gummerman (1971), Lewis (1974) and others were all presenting variations of man-land approaches. Saucier, however, probably had the most impact. In northeast Arkansas Morse (1969) contributed significantly to the cultural ecological domain by suggesting environmental change as an explanation for the depopulation of the Western Lowlands during the Middle Archaic. Klippel (1969) used similar data to explain prehistoric settlement patterns for the Hearn site in southeast Missouri. Other studies have documented correlations between sites and topography (Fehon and Viscito 1974), and soil types (Klinger, 1976; Price 1974).

The cultural ecological period is also characterized by tremendous growth in surveys and excavations. This was made possible by numerous recent Federal regulations requiring consideration of cultural resources (present project included). Coupled with the creation in 1967 of the Arkansas Archeological Survey numerous state wide surveys have been made, including numerous studies in the St. Francis Basin area.

Klinger (1976) recorded over 500 sites in the Village Creek Basin, and Klinger and Mathis (1978) tested the Mangrum site and the Riverdale site, two of nineteen sites located in a survey of a portion of the St. Francis Basin. Other work has been conducted by Padgett (1978), Moore-Jansen and Padgett (1978), Morse and Morse (1980), and Morse (1981).

Northeast Arkansas Prehistoric Sequence

The early cultural history of eastern North America is reflected in the archaeological record of northeast Arkansas. The cultural sequence has been assembled by piecing together data from site surveys, a few excavated sites and local amateur collections. The sequence reveals a cultural growth from small, migratory bands of hunters and collectors to horticultural societies of segmented tribes, and finally to agricultural societies inhabiting towns and building temples. The regional sequence for northeast Arkansas is presented in Table 2-1.

Table 2-1. Outline of northeast Arkansas archaeological sequence.
Times represent the estimated beginning dates of the periods.

Period	Time	Phases
Recent	A.D. 1899	
Historic	A.D. 1688	
Protohistoric	A.D. 1500	Armored?
Late Mississippi	A.D. 1350	Nodena, Parkin, Greenbrier, Walls, Kent
Middle Mississippi	A.D. 1100	Cherry Valley, Lawhorn, Wilson, Powers
Early Mississippi	A.D. 700	Big Lake, Adams, Hayti, Hyneman
Baytown	A.D. 400	Baytown, Dunklin/Barnes
Marksville	A.D. 100	Helena
Tchula:	500 B.C.	Burkett?
Late Archaic/ Poverty Point	3000 B.C.	O'Bryan Ridge/Weona? Frierson?
Archaic		
Dalton	8000 B.C.	
Paleo-Indian	9500 B.C.	

Paleo-Indian

During the time from 12,000 to 8,000 years ago, specialized big-game hunting cultures became widespread in the New World. They coexisted with mastodon and other Late Pleistocene megafauna (Morse 1970:49). Paleo-Indian fluted points are found thinly scattered over northeast Arkansas. They tend to concentrate, however, in a rough linear fashion along relict braided channels in the Cache River Valley west of Crowley's Ridge and at the eastern flanks of Crowley's Ridge along similar relict channels. These finds are in higher and older Pleistocene terrace lands and suggest that people were living on and exploiting riverine environments which have subsequently been modified by Holocene alluviation. Klinger (1976:49) notes several fluted points being found in the Village Creek Basin.

Primary subsistence centered on gathering vegetal foodstuffs, and the hunting of smaller mammals as well as the larger Pleistocene megafauna. According to Morse (cited by House 1975:30), two to three band groups probably occupied northeast Arkansas at the same time.

Dalton

The Dalton period of 8000-7000 B.C. is viewed as a transition time involving a shift from an economy focused on big game hunting to a more diversified economy involving increased use of smaller game and collection of plant products. A Dalton horizon appears to be widespread in the eastern and southeastern United States and to be correlated with the late Plano tradition of the western Plains and the Southwest. The Dalton period in Arkansas and Missouri is traditionally seen as coinciding with a generally warmer early Holocene climate and the replacement of spruce-pine boreal forest with a deciduous forest.

Morse (1973) differentiates Dalton settlement-subsistence patterns from those of Paleo-Indians in northeast Arkansas. He sees Paleo-Indians as having a tight riverine orientation, while Dalton sites are more widespread and occur also in inter-riverine areas. Morse sees Dalton as much more subsistence diversified than the big game hunting Paleo-Indians. He characterizes the settlement pattern as containing numerous specialized extractive camps and a central base camp. Morse (1973; see also Morse and Goodyear 1973) emphasizes the presence in Dalton assemblages of technologically well formed adzes as indicators of a forest adapted, woodworking tradition not present in earlier assemblages.

Archaic

Post-Dalton times are not well known in the immediate St. Francis Basin area. The warmer and drier Hypsithermal climatic period (Wright 1976) equates fairly well with the hiatus between Dalton and Late Archaic times and is frequently suggested as the reason for an abandonment of the area during the Early and Middle Archaic. Morse (n.d.), House (1975:30), Price, Price, and Harris (1976), and Morse (1980a) propose a cultural emigration from the area at this time, and Morse (n.d.:14) further suggests the development of a forest canopy as a reason for the emigration.

Complete depopulation of the Basin, however, is not considered likely. Evidence for the Middle Archaic is noted in the Ozarks and in the uplands of southeast Missouri. Evidence from Modoc Rock shelter in Illinois (Fowler 1959) and the Hidden Valley and Bonaker shelters in Missouri (Adams 1941, 1949; Chapman 1975) suggests a Middle Archaic characterized by straight based bifacial knives and corner notched, stemmed, and lanceolate points (Fowler 1959:37). Big Sandy Notched projectiles and full grooved axes are not typically associated with this period (Chapman 1975). The presence of what are probably Middle Archaic bifaces at site 3MS351 of this project suggests that the St. Francis Basin area was probably at least being utilized for subsistence resources during the Middle Archaic, and it is probable that people were living there also. Morse may well be correct when he asserts that archaeologists may not be recognizing Middle Archaic remains in the northeast Arkansas area because a different set of diagnostics may be present there (Morse n.d.:14).

Late Archaic sites are fairly extensive in northeast Arkansas and can be considered either as an Archaic-Formative transition or as a Late Archaic climax. Perhaps what is most significant about the Late Archaic period is the little amount of work which has been done in the area despite the numerous sites, and the situation has changed little since Morse (1969:19) noted traits in northeast Arkansas Late Archaic sites very similar to those of classic Poverty Point sites to the south.

Molded clay balls or "Poverty Point Objects" are the hallmark of the period in the Lower Mississippi Valley in general. A standard Archaic tool assemblage (stemmed and notched projectile points, atlatl weights, scraping and puncturing tools, pecked and ground stone tools, etc.), is noted, but with increasing emphasis on a lapidary industry involving trade of exotic raw materials and microtools. The appearance of pottery is also attributed to this period in some areas. A continued hunting and gathering subsistence economy is hypothesized, although evidence from the Parkin site (Morse 1981:12) indicates that horticulture may be part of the subsistence strategy.

Settlement patterns for this period are not well understood. House (1975:30) notes that for the area west of Crowley's Ridge the winter settlement pattern seems to consist of camps located in stream bottom areas and composed of several structures. Morse (1980a) postulates that warm season sites are smaller and widely scattered over the landscape, probably exploiting the adjacent uplands of Crowley's Ridge and the Ozarks. A change toward a more clustered settlement pattern late in the period is hypothesized by Morse (1980a) based on concentrations of sites along a relict Mississippi meander near Blytheville, Arkansas and along the White River.

At least two phases have been tentatively identified for the Late Archaic period in the Eastern Lowlands. The Frierson phase is based upon the Frierson site in the Western Lowlands near Bayou de View and on Moore's excavations after the turn of the century along the White River (Morse 1969). The O'Bryan's Ridge Phase in southeast Missouri is identified by Williams (1954). A possible third phase, the Weona, was identified at the Hyneman site (Morse 1975:192). The phase distinction is quite tentative and not fully recognized. All phases are pre-ceramic and are characterized in part by stemmed projectile points and baked clay objects. The applicability of

these phases to the project area remains to be fully demonstrated, however. There simply has not yet been enough excavations of Late Archaic/Poverty Point sites to document fully phase distinctiveness.

Woodland

The Tchula and Marksville periods are not well documented in the area. House (1975:32) notes that no Early Woodland (Tchula) pottery is known from the Western Lowlands, and Morse (1980a) notes the apparent lack of sites east of Crowley's Ridge in the Tchula period. The Tchula period is traditionally recognized as the beginning of the first extensive use of pottery in the Lower Valley, but data for southeast Missouri suggests that the advent of an Early Woodland lifestyle predates the first use of pottery (Chapman 1980:16-18). The problem then becomes one of identification of the Early Woodland in the Eastern Lowlands since it may not be necessarily tied to the presence of ceramics. This may help to explain the Tchula cultural hiatus suggested for northeast Arkansas.

From about A.D. 1 to A.D. 500 the Central and Lower Mississippi Valley received influences from the Hopewellian cultural tradition to the north of Arkansas. In the Lower Mississippi Valley this cultural manifestation is known as the Marksville period. Wide incised lines and zoned rocker stamping are highly distinctive ceramic design motifs. Like Early Woodland in the Lower Valley, burials were in conical mounds, the dead being placed in log tombs on top of prepared earthen platforms. Apparently correlated with the increasing adoption of horticulture, permanent, larger habitation sites occur. Elaborate ceremonialism and trade networks emphasizing exotic raw materials reflective of the Hopewell Interaction Sphere also characterize much of the Valley during this period.

The only known classic Hopewell site in northeast Arkansas is Helena Crossing near Helena, Arkansas. Scattered Hopewellian ceramics are occasionally documented for the area, but they tend to be concentrated along the Cache River and Bayou de View (House 1975:32).

The Baytown period (Late Woodland) is well documented for northeast Arkansas. Two distinct pottery traditions exist in the general project area during the Baytown period. These are the grog tempered Baytown tradition ceramics of the Baytown and Hoecake phases and the distinctive sand tempered Barnes tradition ceramics (renamed Kennett Plain by Phillips) of the Dunklin phase (Phillips 1970:902-903). This latter ceramic type is tightly clustered in southeast Missouri and northeast Arkansas (see Price 1976:27; Morse 1980c:30), and is hypothesized to represent a migration into the largely uninhabited St. Francis Basin area (Morse 1980b) in early Late Woodland times.

Morse is of the opinion that both Baytown and Barnes tradition cultures are moving toward each other in the St. Francis Basin area, with Baytown encroaching on Barnes territory from the south (and probably from the north also). In fact, the overlap between the ceramic traditions is interpreted by Morse as resulting from the amalgamation (not acculturation) of the two groups (Morse 1980c). Dunklin phase (Barnes) groups are hypothesized to be weakly structured. This is because, unlike the Baytown and Hoecake phases occupation, Dunklin (Barnes) is noted for its lack of mound sites and lack of long range trade as evidenced by an absence of exotic raw materials. A decentralized tribal organization is hypothesized for Dunklin (Barnes) with individual autonomous groups exploiting a territory or "neighborhood" (Morse 1977:198).

Mississippian

The Early Mississippi period in the immediate project area is identified with the Big Lake phase. The type site is the Zebree site located in the vicinity of Big Lake. The Big Lake phase is hypothesized to be a direct site intrusion or migration from the Cairo Lowlands to the north (Morse 1977:201; 1980:15; 1981:13). This development, perhaps inspired by Cahokia, is thought to be the result of a new and diverse exploitative potential brought about by the developing Big Lake topographic feature around A.D. 800.

Beginning around this time there is a sharp increase in the number of sites in the Mississippi Valley, probably related to the development of agriculture. Certainly, the bow and arrow had replaced the dart and atlatl by this time (Brain 1976:59; Morse 1969:22).

Middle Mississippi occupation is widespread by A.D. 1200. An increase in site density is noted over the region as indicated by the Powers phase expansion along the Little Black River, the Lawhorn phase along the St. Francis River, and the little known Wilson phase along the Cache in Craighead and Lawrence Counties. This increase in site density is best noted in the Cairo Lowlands area north of the project area, indicating for that area more extensive and concentrated population than in the St. Francis Basin area in Arkansas. This is evidenced by such sites as Hearnese, Lilbourn and Towosohgy. As Morse (1980a:10) points out, this increase in site density probably reflects the ecological and political changes brought about by intensive agriculture.

The Late Mississippi is marked by a general demographic collapse of the preceding Middle Mississippi phases, perhaps as a result of drought (Baeris and Bryson 1965). Williams (1977; 1980) suggests that much of the central area of Mississippian development is abandoned, referring to it as the "Vacant Quarter". He also identifies the Armorer phase (1980), located along Pemiscot Bayou in the extreme southeastern tip of Missouri. The material culture appears to have no antecedents in the locality and is probably related to developments in the St. Francis Basin. The abandonment appears to be related to a southward population shift of the Lawhorn, Wilson, and Cherry Valley phases (Morse 1980a:19), and a corresponding increase in population in extreme northeast Arkansas represented by the Nodena phase, the Parkin phase on the St. Francis River south of Marked Tree, the Greenbrier phase in the vicinity of Batesville on the White River, and the Walls and Kent phases south and west of Memphis, Tennessee (see Morse 1981:15, Fig. 4).

The Proto-historic period is one of a general population decrease in the area, most probably enhanced by European diseases introduced into the area (Morse 1969:24; Brain 1971:82). Also, environmental factors have again been suggested as a causal factor (Morse 1969:24).

Proto-historic and Historic Perspectives

This historical period of northeast Arkansas has been influenced by four factors: 1) European political instability, 2) United States federal policies, 3) land reclamation, and 4) transportation. All four of these factors were at least partially dependent upon the geomorphological characteristics of the region. The following discussion will address the history of northeast Arkansas in terms of these four factors.

European Political Instability

The initial contact of St. Francis Basin Indians with Europeans was in 1541 when Hernando de Soto led a band of Spaniards into northeast Arkansas. The exact route of the party is uncertain, as is the point at which De Soto crossed the Mississippi River into Arkansas. The location of De Soto's crossing is important to the regional history because it affects the presumed placement of Late Mississippi Indian groups living in the area. This is because early Spanish accounts identify Indian groups at a measured distance (leagues) up or down from their crossing point.

One of the earliest attempts at determining the location of De Soto's crossing point is by Nuttall (Thwaites 1905). Nuttall identified Memphis Crossing as the point at which the De Soto party crossed into Arkansas. Several thousand Indians were believed to inhabit the area in the vicinity of the crossing. Three other areas have been suggested as river crossing points. Sunflower Landing approximately 80 miles south of Memphis was the area chosen by Swanton (1939) as the crossing point. Phillips, Ford and Griffin suggested that Commerce Landing (30 miles south of Memphis) was the point of the river crossing (1951). The last point identified for the expedition is Friars Point, near Sunflower Landing (Brain 1974).

An account of De Soto's expedition is outlined by Morse (1981:61-72). Briefly, at least four groups of Indians (identified as provinces by the Spanish) are described by Spanish accounts. These are the Casqui, Aquixo, Pacaha, and Quiguate. The Aquixo were encountered first some 1.5 leagues up the river from the crossing site (about 7.2 km). Next encountered were the Casqui, located a few days upriver from the Aquixo. The Spanish are noted as spending several days in this province with one town having about 400 houses. Between major settlements smaller villages composed of 15 to 40 houses were documented. Settlements are described as being located on what are probably natural levees along the river banks. Corn is also mentioned as a staple food source. The chief's village is reported to have had a mound on which the chief's house stood, and which was surrounded by additional structures for his wives and servants.

The province of Pacaha was next visited by De Soto accompanied by an entourage of Casqui. A large palisaded town composed of some 500 houses was visited by De Soto and eventually sacked by the Casqui. De Soto then back-tracked to the south through Casqui country to the Quiguate province which also supported a large population and town. Upon completion of his trek through northeastern Arkansas, De Soto moved toward the southwestern part of the state.

Locating the sites visited by De Soto is difficult at best. Depending upon the point of the crossing various Late Mississippi phases can be roughly correlated to the route of the expedition. Morse (1981:67-69) presents a comparison of three hypotheses, correlating present archaeological phases to the provinces defined by the Spanish. This comparison is presented in Table 2-2.

De Soto's encounter was followed over 100 years later by a team of French explorers led by Joliet and Marquette. They entered the Mississippi Valley from Canada in 1673, and, by some accounts, may have visited the capital of the Casqui (Edrington 1962:24). Carpenter (1949:33) disputes this, however, stating that the Casqui had moved north of the mouth of the Missouri River by this time.

The French presence was again felt in 1682 when LaSalle attempted to connect French settlements to the Gulf along the Mississippi River. The expedition was little more than an attempt to make the Mississippi Valley a French settlement, and LaSalle claimed the valley in the name of the French king. LaSalle's efforts to colonize the valley were largely thwarted by the arrival of the English fur traders from the east coast in the last decade of the seventeenth century, and by the Spanish who were already contesting for their share of the potential wealth of the Mississippi Valley. The Mississippi Valley became an intense focus of conflict and interest between the major European powers for the next century. LaSalle was followed by Henri de Tonti in 1686 who established a trading post at the Menard Mounds site on the Arkansas River (Ford 1961).

Generally, the French placed the Indian populations in a higher regard than the Spanish, who looked more toward exploitation than colonization. Two of the earliest attempts to colonize the general region were Arkansas Post (John Laws colony) in 1688 and St. Genevieve (Missouri) in 1735. Numerous lesser fur trading outposts were scattered between these points. Significant further development by the French was halted by political events. In 1762, as a result of the Treaty of Paris which ended the Seven Years War, the French ceded to the Spanish their lands along the western half of the Mississippi; the British were allotted the eastern half. Under inducements offered by both governments (especially Spanish land grants) immigrants were brought into the territories who inevitably displaced the local Indian inhabitants, forcing Indians to take sides. Northeastern Arkansas, however, remained largely unsettled by Europeans because of the dominance of swamplands in the area.

The Spanish divided their holding into numerous political provinces, including the New Madrid Province established in 1785. The province included what is now northeast Arkansas, running from roughly the present town of Commerce, Missouri south to the mouth of the St. Francis River. The Spanish retained loose control over the area until the Treaty of San Ildefonso in 1800. Spanish holdings were ceded to France, which sold the territory known as the Louisiana Purchase to the United States in 1803.

Table 2-2. A comparison of various theories of the De Soto route
(taken from Morse 1981, Table 5).

Spanish Province	Spanish Account	Phillips et al. (phases & sites)	Brain et al. (phases & sites)	Morse (phases & sites)
River crossing		Commerce Landing	Friars Point	Commerce Landing
Aquixo	No name given	Many, including Belle Meade	Old Town	Walls phase
Casqui	400 house town principal village (another on way)	Parkin phase; Parkin or Neeley's Ferry	Kent phase; Moore Starkley, Grant, or Green, Kent	Parkin phase, 3SF9, Parkin, 3CT22, or 3CT18
Pacaha	Capital	Pecan Point	Walls phase; Belle Meade	Nodena phase; Pecan Point
Mountains Northwest		Not mentioned	Not mentioned	Western Lowlands
Quiguate	"largest village in Florida"	five sites, including Clay Hill	Dupree	Kent phase

Early United States History

Until the Louisiana Purchase there were few substantial European settlements in the project area. The St. Francis Basin was best suited to immigration from the north, principally from the Ohio River area. Colonization could proceed either along the levees of the Mississippi River or the St. Francis River, producing a linear north-south settlement pattern. East-west settlement was limited because of the interior swamplands between the two river systems. Carpenter (1949) proposed a model of settlement based upon these physiographic features in the southeast Missouri lowlands, and this model can be extended into northeast Arkansas.

A linear north-south pattern of widely spaced large settlements is present on the uplands (Crowley's Ridge, Sikeston Ridge). East-west settlements (located on terraces or small streams) were very small and close together, frequently a mile (.621 km) or less apart. Carpenter sees this pattern as a result of economic distribution problems brought about by the swampland. Transportation of goods and services was relatively easy along the uplands; however, low swampy areas impeded movement east-west, necessitating a close grouping of trade centers in that direction.

The District of Arkansas was created in 1806. It was composed of the present state of Arkansas plus a large portion of what is now Oklahoma. The Louisiana Purchase was instrumental in bringing people into the valley because of the liberal terms of land acquisition the United States government set up. The New Madrid earthquake of 1811, however, may have dissuaded early development. The government offered Arkansas land in exchange for land damaged in the New Madrid area, but participation was slow in developing. Although parts of Arkansas and Missouri saw some of the earliest French settlements in the New World, early maps of the St. Francis Basin show little evidence of substantial settlement until the early decades of the nineteenth century.

With the admission of Louisiana to statehood, the District of Arkansas became associated with the newly created Missouri Territory in 1812. The district was further redefined by creating Arkansas County, designated as including all the Missouri Territory south of New Madrid. A census of male voters taken in 1812 showed 827 (Edrington 1962:27). In 1819 Arkansas County was made into the Territory of Arkansas, and in 1836 Arkansas became the 25th state.

Mississippi County was surveyed between 1824 and 1826. Population was principally located along the banks of the Mississippi River, with Osceola being selected as the county seat. The interior was till largely unsettled until reaching Crowley's Ridge. In fact, it is not until 1844 that a permanent white settlement in the St. Francis Basin was recorded (Stuck 1960:72-73). This was the small pioneer village of Mangrum, southwest of Black Oak. By 1848 State Land Office survey maps show farmsteads along the St. Francis and the Left and Right Hand Chutes of Little River (Klinger and Mathis 1978). Population of Mississippi County in 1854 was 2266 whites and 541 slaves (Edrington 1962:30). By the turn of the century county population was about 8000 (Edrington 1962:30), although as late as 1902 Mississippi County was declared to be 90 percent composed of a "hopeless malaria ridden swamp" (Simonson 1947:419).

Land Reclamation

Perhaps the single event most important to the historical development of northeast Arkansas was the draining of the so-called "sunk lands". In 1850 the United States Congress passed a Swamp Land Grant Act directed at Arkansas which was based upon a similar act the preceeding year in Louisiana. The act in effect gave over to the State of Arkansas those federally owned swamplands (about 8,600,000 acres; 3,484,000 hectares) within its borders. The state was to reclaim the land by a system of draining and levee building. In 1851 three swampland districts were created in Arkansas to manage the reclamation, one of which included Mississippi County. By 1852 sixteen miles (26 km) of levee had been built (Harrison and Lollmorgen 1947:379).

Additional significant efforts were accomplished by the establishment of the Mississippi River Commission in 1879. Coordinated with the creation of the St. Francis Levee District in 1893, this event marked the beginning of modern flood control in northeastern Arkansas.

Transportation

The Mississippi River, of course, played an important role in the early development of the region. It was along this waterway that the first settlements were established, usually as fur trading centers. With the advent of the steamboat, shipping and receiving became much easier and more profitable. This ultimately enabled some early settlements such as Osceola to prosper and grow.

The St. Francis River initially saw only limited commercial steamboat traffic, beginning in the 1830s. This was primarily the result of a sparse population in the area, although another factor may have been logjams reported to have blocked the river for some time (Dougan 1976:3).

The period following the Civil War saw increased steamboat trade. Klinger and Mathis (1978:24) note commercially operated steamers stopping at designated landings along the St. Francis and Little Rivers. The fact that the lesser streams of the area were navigable only by small boats, and that their general orientation was north-south, detracted from their importance as major east-west trading channels.

The development of the railroads probably did the most toward aiding the development of the St. Francis Basin. The north-south settlement pattern established by the early immigrants into the area was also altered.

After the declaration of the Swamp Land Grant there was considerable interest in giving much of the swamplands to the railroads to offset state problems of administering the vast tracts of swamp. Considerable holdings of the swamplands were granted to the railroads in the 1850-1870s.

By the last decade of the nineteenth century numerous railroads had been created to move goods (principally logs) in northeast Arkansas and Missouri. Rivalries between developing communities and extensive timber resources aided in this development. The general plan of the state for fast development by the railroads of the swamplands was, however, not met.

The railroads had completely by-passed the "sunk lands" during the decade of the 1880s, the era of great railroad building in Arkansas. The main trunk lines which traversed northeast Arkansas followed the north-south orientation of the ridges (Fig. 2-1). Their location was, as with early settlements, laid out to conform with topographic limitations imposed by the swamp lands. As a result, much of the St. Francis Basin was still sparsely settled by 1890, except along the major drainages. The "sunk lands" were accessible mostly in dry weather, during which a few attempts at logging the area were being made.

By the turn of the twentieth century a significant alteration of this pattern had been established. In 1899 a major east-west railroad, the Jonesboro, Lake City and Eastern Railroad (JLC&E), was operational between Leachville, and Jonesboro (Fig. 2-1). The significance of this was that the vast forests and swamplands of the "sunk lands" had finally been penetrated. Logging interests, which had only marginally worked in the area by floating logs to market, were now able to expand their holdings and exploit large tracts of timber resources at a profit. Entire towns were created along the line, such as Black Oak, established as a sawmill community. Other small communities, such as Leachville, settled in 1897 (Cashion 1976), and Monette grew rapidly in population. By 1902 the railroad reached Blytheville, itself an early important commercial center for the north-south trade.

The surge in timber development by railroad interests was relatively short lived. By the third decade of the twentieth century much of the timber resources were dwindling. Decreased revenues and heavy flooding in 1913 (destroying miles of track) made the railroad a more risky venture.

As a result, timbered lands owned by the railroads were offered for sale and agricultural development was encouraged to replace logging revenues. By the end of the World War I, agriculture had surpassed logging as the main industry in the area, although periodic flooding was still a problem. Sawmills in towns such as Lake City and Monette were being replaced by cotton gins.

To conclude, geomorphological characteristics greatly influenced the type of settlement pattern which could be utilized over northeast Arkansas. Settlements were established following the north-south trending ridges east of the Ozark Uplands. Expansion was conditioned by progress in drainage development and forest removal. This was the pattern of development until the twentieth century when technological capabilities and economic interests finally merged to produce development in an east-west trend across northeast Arkansas. With this development small east-west logging/agricultural commercial centers developed which were able to fully participate in the former north-south socio-economic development.

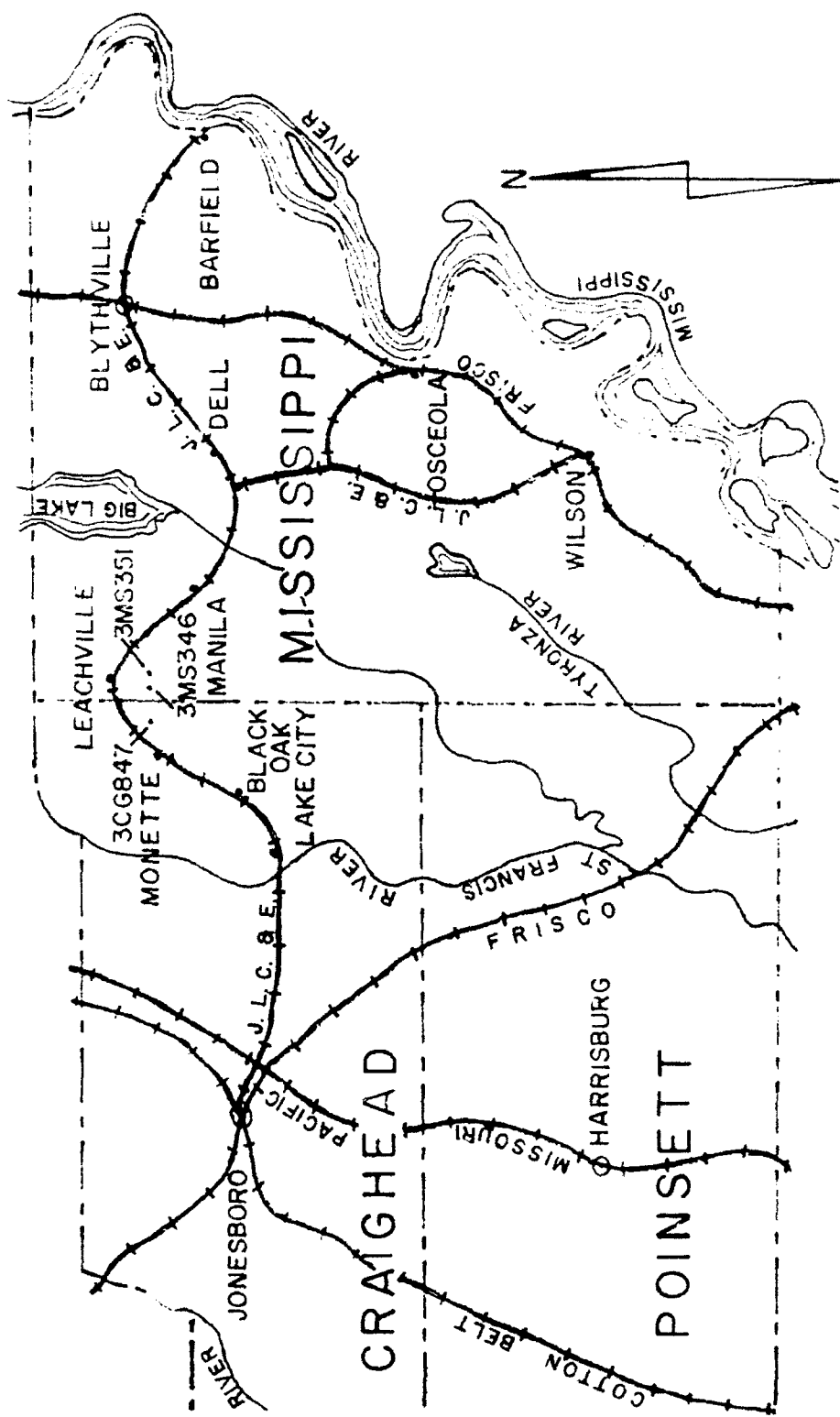


Figure 2-1. Early Railroads in northeast Arkansas, ca. 1902 (after Dew 1968).

CHAPTER 3

Research Design

Introduction

The research design presented here is organized within two major problem domains: (1) problems pertaining to cultural historical relationships, and (2) problems pertaining to cultural ecological relationships. A detailed list of specific current research topics, questions, and hypotheses has been presented in the Arkansas State Plan for the northeast part of the state. We see this Research Design statement as a mechanism for integrating and organizing those specific questions and for presenting our general research interests for this project.

It is important to note that this Research Design was written prior to the beginning of field work on the project. Some changes in tense and syntax have been made to make it more readable within the context of this report, but it was felt important to present to the reader the research principles that guided our work from the beginning. The final chapter of Volume II of this report compares our general findings with the research interests and expectations presented here.

Cultural Historical Problem Domain

This problem domain includes several areas of study concerned with temporal placement, population movement, ethnic boundary identification, relationships between regional archaeological complexes and ethnographically known groups, and assessment and refinement of regional archaeological taxonomies. Such problems have a long history in North American archaeology and, in many ways, are basic for more recent, cultural ecological studies. In many cases it is difficult to separate cultural historical and ecological analyses. The division here is primarily for ease of presentation and does not mean that we see rigid boundaries for the two analytical domains.

We have adopted for the presentation of research problems within the cultural historical domain a period by period approach, organized by units commonly used in studies of the Central and Lower Mississippi Valley. Within these major periods taxonomy follows that presented in sections above.

Paleo-Indian

Archaeologists have not discovered preserved sites of the Paleo-Indian period in the project area, although potential Paleo-Indian age soils may be present. While over 100 fluted points are known for the Eastern Lowlands in northeast Arkansas (Morse and Morse 1980: Chapter 1, page 9), these are all surface finds, and no preserved sites have been investigated. Cultural-historical problems for the Paleo-Indian period in the region concern primarily the relationship of Clovis-like points to later styles such as Dalton and to better defined Paleo-Indian complexes to the West. Obtaining reliable dates for Clovis, Quad, Suwannee or other potential technical styles would be a major taxonomic contribution. Also important would be the association of other specific tool forms (e.g., distinctive scrapers) with any of these point styles. Such association might increase our diagnostics for the period and allow progress in solving problems of cultural historical trajectories into the Archaic period.

Dalton

Dalton sites are relatively well documented for northeast Arkansas (Goodyear 1974), and most research has focused on cultural ecological and adaptational questions. At present there appears to be little cultural-historical variability (i.e., phases) within the Dalton "horizon" over the entire Southeast. Cultural-historical research problems for Dalton include more precise dating, possible recognition of variability within the taxonomic unit, and possible discovery of forms transitional to Clovis-like fluted points or to the side-notched and stemmed points of the Early Archaic. Site 3MS351 contains a preserved Dalton component. A Dalton point was recovered from the surface, and test pits (Iroquois 1978) indicated possible early levels (but without diagnostics).

Early and Middle Archaic

The project sites were thought from survey data to contain no recognized Early or Middle Archaic components, and previous survey in the region (see Morse and Morse 1980; Chapter 1, page 11) has indicated a probable abandonment of the region during this time. Our excavations and analyses closely examined this cultural hiatus by searching for point styles diagnostic of this period and documented in the Ozark Highlands to the west and the Tennessee uplands to the east.

Late Archaic

Late Archaic is poorly understood in northeast Arkansas although sites with Poverty Point - like assemblages are known for the region. Based on the presence of points (found during the original survey) of the Stone Stemmed type, site 3MS351 and 3CG847 have been recognized as having Late Archaic components. We attempted to document better such occupations at the sites and to compare them with assemblages from Late Archaic complexes better known in the highlands to the east and west, and in the Mississippi Valley to the south.

Early-Middle Woodland

Early Woodland (Tchula) and Middle Woodland (Hopewell) are not well represented in northeast Arkansas, and no components dating to these periods have been recognized at the three project sites.

Late Woodland

Late Woodland components are present at all three project sites, represented by Barnes sand tempered pottery. A major cultural historical problem in northeast Arkansas involves the relationship of Barnes pottery to the similar but grog tempered ceramics to the south referred to as Baytown. Most researchers view these two ceramic groups as representing distinct peoples of tribes (Morse and Morse 1980: various). The two groups are seen as contemporaneous, with Baytown moving north and replacing Barnes in its southernmost areas late in the period. The project sites lie close to this "frontier" or "tension zone," and while no Baytown sherds were identified during the survey phase work at the sites, we expected Baytown to be represented. We carefully analyzed Late Woodland ceramics by establishing types and closely inspecting temper and decorative traits to see if patterns reflective of the Baytown-Barnes interaction existed at the sites. We also sought to document other artifact types, particularly points, as diagnostic of either Barnes or Baytown.

Early Mississippian

The Early Mississippi period is well documented in the northeast Arkansas Eastern Lowlands by the landmark work performed at the Zebree site just east of the project area (Morse and Morse 1980). Following Barnes at Zebree was a large Early Mississippian component, defined as a regional center for the Big Lake phase. Pottery types used as diagnostic markers are Varney Red Filmed and Neeley's Ferry Plain.

Morse (1980a:7-9) sees the Big Lake phase, and particularly the regional center at Zebree, as originating in a migration directly from Cahokia. He sees little in the way of transition indicators for Barnes (or Baytown) to the Big Lake phase. Furthermore, Morse sees close similarities with the contemporary Fairmount phase at Cahokia, especially the microlith industry and the distinctive chert present in both Fairmount and Big Lakes phases.

At all three project sites Neeley's Ferry Plain and Varney Red Filmed pottery was found during the original survey, indicating probable close association of occupations at these sites to the Big Lake phase regional center at Zebree. We closely examined the distribution at the three sites of these pottery types, as well as other distinctive artifacts, motifs, material categories, and feature data, to document this association and to explore further the postulated relationship between Barnes and Big Lake (evolution, acculturation or migration, replacement).

Middle Mississippian

At the Zebree site the Big Lake phase is followed by a dramatically smaller, less intense occupation by a later Mississippian group known locally as the Lawhorn phase. Ceramic markers for the Lawhorn phase are Neeley's Ferry Plain jars having a slightly straighter rim profile than Big Lake phase rims, along with the closely related Matthews Incised and Manly Punctated types. The Buffalo Creek Diversion survey report describes Middle Period Mississippi (presumably Lawhorn phase) components for all three sites tested. However, this designation was apparently based only on finding Neeley's Ferry Plain sherds at the three sites. Matthews Incised and Manly Punctated types were not described. While Varney Red Filmed ceramics were found at all three sites, indicating Big Lake phase occupations, we were not certain if the Lawhorn phase was indicated. We closely examined the Iroquois Research Institute survey collections, as well as our additional data, to attempt to document a Lawhorn phase occupation.

Later Mississippian and proto-historic occupations are not represented in the survey collections from the three project sites, nor are they widely distributed in the Big Lake region.

Cultural Ecological Problem Domain

Within this problem domain we examined questions pertaining to the adaptation of prehistoric populations to their environment. Following White (1959), anthropologists and archaeologists have given primacy to economic and environmental adaptation variables as the important factors in cultural evolution. Increasingly, they have seen studies of settlement-subsistence organization and related economic aspects of cultural systems as having broad explanatory power for evolutionary analyses. Under this problem domain, we examined several general and specific hypotheses and problem areas. These are presented below as major hypotheses and problem areas. Under each of these headings, we discuss aspects relating to the various cultural historical periods.

Paleoenvironmental Reconstruction

Detailed paleoenvironmental reconstruction was undertaken in the Zebree site analysis (Morse and Morse 1980). Much of this is directly applicable to our project area. We hoped to supplement the Zebree analysis with detailed studies of our site localities. We placed particular importance on determinations of the age of various deposits, amount of pedoturbation, and the conditions under which these deposits were formed. From these studies and supplementary studies of pollen, other floral remains (seeds, nuts, etc.), and faunal remains, we anticipated that we would be able to describe the general nature of past regional environments and detailed characteristics of past microenvironments.

Settlement-subsistence

This research area forms the largest problem set within the cultural ecological domain; it is, however, difficult to subdivide as research questions are interwoven tightly. We discuss below several of the important research questions within this general area.

It was possible, although not likely, that we would encounter Paleo-Indian remains at site 3MS351. If so, any data at all we could gather concerning settlement or subsistence patterns would have been a contribution to regional prehistoric studies. Most fluted point surface finds, however, have been along the major waterways within northeast Arkansas, the Cache River, and, in the Eastern Lowlands, the St. Francis River. While it is possible that Paleo-Indian remains are preserved along relict Mississippi River braided channels generally documented for the project area (Saucier 1974), the probability appears to be low.

Dalton occupations in the regions are much better documented and appear to represent a population increase or expansion into the area. Morse (1973, 1977) has proposed a model for Dalton settlement systems in the region involving relatively permanent base camps with ancillary exploitation camps (separate for hunting-butcher, plant gathering, and stone quarrying) and with separate cemetery sites. Schiffer (1976) proposes an alternate model involving a greater number of less permanent base camps, and extraction stations with very low archaeological visibility. Essentially, Schiffer seems to redefine Morse's

food extraction camps as temporary base camps, and then to state that it is unlikely that archaeologists can recognize true extraction camps. We initially saw available data for northeast Arkansas as more strongly indicating Morse's ideas. Using our Dalton component at 3MS351, we hoped to document a Dalton hunting-butchered or plant gathering station that would provide data to assist in better defining this settlement type and in further informing on Dalton subsistence practices. However, our analysis led us to view the data as better conforming, in some respects to Schiffer's ideas.

Morse and Schiffer also disagree concerning the shape of Dalton territories or seasonal round areas. While again we see Morse's ideas of Dalton territories conforming to drainage basins as better representing available regional and ethnographic analogy data, we do not feel that our potential Dalton component can assist very much in resolving this controversy. We have attempted to comment on this, however, in Volume II of our report.

The early and Middle Archaic periods were not thought to be represented at our three sites, and it was generally felt that human groups moved out of the Mississippi Valley lowland areas during this time, probably in response to drier conditions represented by the Altithermal or Hypsithermal climatic period (Morse and Morse 1980). The effects of changing climate during this period on the environment of the general project region, however, are not well documented. We hoped that we would be able, with our pollen studies, to better estimate environmental effects during this period and examine more closely the presumed cultural hiatus. Chapter 6 of Volume I focuses on this environmental problem, and our discovery of Early and Middle Archaic occupation at 3MS351 are discussed in Volume II.

During the Late Archaic human groups apparently moved back into the area, although sites are still relatively infrequent and little is known of their settlement or subsistence patterns. It is presumed that hunting and gathering was still dominant, although some horticulture may have been present. We hoped to document through pollen and other floral studies early beginnings of horticulture if preserved Late Archaic components were present.

We have no components dating to Early or Middle Woodland represented at the three project sites, and, again, this is a poorly known time span for northeast Arkansas. It is felt that this was another period of population movement out of the region (Morse and Morse 1980).

The Late Woodland period in northeast Arkansas is evidenced by a number of sites, and all three project sites contain Late Woodland components. In the Big Lake region the Late Woodland phase is Dunklin (Barnes), although Baytown is dominant to the south and is presumably encroaching on Barnes during the later part of the period. Little is known of Barnes other than ceramics (Morse and Morse 1980). Based on survey data and excavations at the Zebree site, Barnes is seen as much less complex than Baytown, with relatively independent small villages widely scattered in the region. A seasonal pattern involving dispersed family units in the warm months and winter camps of up to four households has been hypothesized, but data are meager. Studies of the Dunklin (Barnes) phase at the Zebree site indicated that subsistence was still based on hunting and gathering, although possible sunflower cultivation was indicated.

Corn association with a Barnes feature was very doubtful. Barnes storage pits at the Zebree site indicate relatively stable occupations and a well organized subsistence system. We planned to study very carefully any features encountered in the three project sites through flotation and pollen analysis, and to analyze any preserved faunal remains for subsistence information. Indirect evidence for subsistence, in the form of tool proportions and activities indicated for the site, were also analyzed.

From the survey data for the three project sites it was speculated (Iroquois 1978) that the Barnes occupations probably represent small one or two household campsites. We hoped to be able, from direct subsistence evidence such as floral and faunal remains, to estimate season of occupation of the sites. Feature, structure, and community plan data would assist in these determinations.

We expected Mississippian occupations, both Big Lake and Lawhorn phases, to be agricultural and conform to patterns identified at the Zebree site. Survey data for our three sites indicated that both occupations should have been characterized as small farmsteads with a primary dependence on corn agriculture. While we planned detailed subsistence, settlement, and seasonality analyses for expected Mississippian components, we recovered too few data from these ephemeral occupations at the three sites to draw many conclusions.

Demography

Demographic data for prehistoric populations is difficult to acquire with accuracy. The best estimates of demographic variables come from sites or populations with mortuary features, or, to a lesser extent, with clear evidence of community plans. These characteristics are rare for Southeastern sites, particularly for Archaic and Woodland components. If we had been fortunate enough to recover human burials or even good evidence of the number and structure of houses, we may have been able to make good demographic estimates. We were, however, forced to make broad estimates based on measures of site size and artifact/feature density.

Lithic Resources and Manufacturing Sequences

The types of lithic materials that prehistoric groups selected for tool making are important indicators of more general economic patterns of those groups. Various types of stone have different flaking properties, hardness (use qualities), and availability. The mix of stone types that the various groups used, the types of tools that they made from each stone type, and the character of the manufacturing sequence can inform us about variables such as curation, group movement, trade, or, possibly, specific subsistence shifts.

The variety of stone types used in the project area include Crowley's Ridge Chert to the west, Burlington or Boone Chert from the Ozarks farther west, and, possibly, Crescent Quarry Chert from just south of present-day St. Louis. We undertook detailed studies of these stone types for the various periods. Chapter 7 of this volume describes lithic resources of the region. As none of this material is local to the site area, we focused (in Volume II) primarily on the procurement systems necessary to obtain lithic raw material and the impact of these systems on interpretations of the archaeological deposits.

Trade

Recent prehistoric research has focused on exchange systems, and we hoped the sites under study would be able to contribute directly to knowledge of such prehistoric systems. Winters (1968) has discussed possible trade networks in the eastern U.S. for Archaic, particularly, Late Archaic peoples. We searched for evidence of imported items (as well as styles and motifs) along with evidence of craft industries for trade. It was suspected that if such material were present, it would take the form of modifications of functional tool forms (e.g. specialized bifaces) or raw materials (shell, stone, copper). We analyzed whether trade or extraction is indicated by such non-local materials.

The importance of considering trade networks and interaction sphere participation with a cultural ecological perspective is that such trade may represent a very effective adaptation to lessen the effects of short term subsistence disasters. Cyclical weather patterns may result in local productivity decreases, which the inhabitants could compensate for by importing from an unaffected area. Thus, researchers see the establishment of such networks as an important evolutionary development accompanying sedentism and abandonment of a far-ranging seasonal round.

Socio-political Organization

Studies of the evolution of socio-political organization are often difficult to undertake with archaeological data, but we were hopeful that the sites under study would be able to contribute to this research area. Service (1962) and Fried (1967) have outlined basic evolutionary stages and processes for change from a band level society to tribal organization, and then to chiefdoms, as well as the progressive development of (class) stratified societies from egalitarian organizations. These steps or stages seem to be present in the eastern U.S., and the Southeast, with Paleo-Indian through Archaic groups usually seen as having egalitarian band organizations, Woodland groups showing development of tribal organization, and Mississippian cultures organized in stratified chiefdoms.

Data bearing on this development at the three sites under investigation were sparse. We searched for evidence of social stratification in the spatial arrangement of items of differential status at the sites. Burial associations may show status differential, as may house types, but neither were encountered. In general, recurring patterns of such status differentiation should be evident to support claims of social stratification (ascribed status). Isolated status differences may indicate only achieved status, which may be present in all organizations, including band societies.

Summary

The scope of work for the Buffalo Creek Diversion Project detailed several research problems for the three sites to be studied.

- (1) The subsistence activities in this area during the Late Paleo-Indian Period (3MS351), the Late Archaic Period (3MS346 and 3MS351), and the Late Woodland to Middle Mississippian Periods (all three sites);
- (2) study of the intra- and inter-site variability in the Barnes pottery types (all three sites); better definition of the local Late Archaic Period cultural phase(s) (3MS346 and 3MS351);
- (3) study of the community patterning characteristic of Late Woodland Period settlements (all three sites);
- (4) study of the lithic raw material preferences associated with the Late Woodland to Middle Mississippi Periods cultures (all three sites);
- (5) elucidation of the functional role of the small hamlet in the overall Late Woodland to Middle Mississippi Period settlement patterns (3MS346);
- (6) collection of data relevant to the study of culture change from the Woodland to Mississippian cultural traditions (all three sites), and;
- (7) the relationships of these sites to other sites of the same periods in the region.

We feel our Research Design covers these topics and, as well, places them within an organized, systematic study plan incorporating both cultural historical and cultural ecological research questions.

CHAPTER 4

PHYSIOGRAPHY AND GEOLOGY

Introduction

It has long been recognized by students of archaeology and geology in the Mississippi Valley that the two disciplines could be simultaneously employed to the benefit of both (McIntire 1958; Saucier 1963, 1974, 1981; Morse 1969; Schiffer and House 1975; Morse and Morse 1980). Many of the early interdisciplinary projects occurred in coastal areas (McIntire 1958; Saucier 1964). Inland, Phillips, Ford and Griffin (1951), and Phillips (1970) attempted to correlate sites in the Lower Yazoo Basin in central Mississippi with geological features. However, they were more concerned with establishing a ceramic classification system for use in phase determinations than in relating specific sites to their paleoenvironment. Phillips (1970) did, however, offer early interpretations regarding prehistoric occupations along major meander belts of the Mississippi River. He may have gone further had he not been thwarted by a heavy reliance on Fisk's (1944) outdated channel sequences.

An important trend in archaeological studies over the last decade has been interpretation of the evolution of man-land relationships. Although archaeologists have long been interested in geology for data concerning the dating of buried land surfaces and the disturbance to archaeological deposits *ugh erosion and other geological processes, increasing attention has been devoted to utilizing geological, geomorphological, and soils data in reconstructing topographic, hydrological, climatological, and biotic details of past microenvironments.

One of the goals of our research during the Buffalo Creek Archaeological Project was to understand the present and past environments of the project region and area so as to evaluate better the relationships between these and the evolution of prehistoric groups in the area, particularly as represented by the three sites under study. Our first step was to review existing literature and to define our area of study. We present here a summary of this review, followed by a discussion of the geological/geomorphological processes affecting the physiography of the area. Following this we describe the several land surfaces present in the project area and their origin, concluding with a discussion of our own research concerning the soils at the three studied sites. The three following chapters in this volume are also concerned with aspects of the sites' environment; they present details of the biotic environment of the project area, an hypothesized reconstruction of the early Holocene environment, and a discussion of the lithic resources available.

Northeastern Arkansas is generally divided into three major physiographic regions: (1) the Eastern Lowlands, containing the present Mississippi and St. Francis Rivers; (2) the Western Lowlands, containing the Cache River and its tributary, Bayou DeView; and (3) Crowley's Ridge, an upland erosional remnant separating the Eastern and Western Lowlands (Fig. 4-1). Early geomorphological studies in the Eastern and Western Lowlands by Fisk (1944, 1951) focused on delineating relict stream channels, identifying distinct terrace formations, and estimating the ages of the various depositional surfaces and events. More recent work by Saucier (various, but especially 1974, 1981) has greatly refined Fisk's conclusions, most importantly perhaps in age estimates of the various topographic surfaces. In the Eastern Lowlands, Fisk thought all present surfaces to be at most 6,000 years old; it now appears that this age estimate is a minimum, with some deposits dating to 18,000 years ago. Such a major chronological revision has had major effects on the interpretation of archaeological data, particularly on identifying areas of potential archaeological deposits.

The Western Lowlands region is bordered by Crowley's Ridge to the east and the Ozark Escarpment to the west. Three major terraces have been identified in the Western Lowlands (Smith and Saucier 1971), resulting from glacial outwash deposited by a braided regime Mississippi River during the early Wisconsin period 30,000 to 50,000 years ago. Eolian sand dunes, formed 20,000 to 25,000 years ago from braided stream point bar deposits, cover portions of these terraces. At about 18,000 to 20,000 years ago the braided Mississippi changed its course to the Eastern Lowlands. The present flood plains of the Cache River and its tributaries were then incised into the Western Lowlands braided stream terrace deposits.

The Eastern Lowlands are characterized by four major terraces dating to about 18,000 years ago when the braided Mississippi began to flow through this region. Terraces are generally younger as one moves east, corresponding to the eastward shift of the Mississippi after 18,000 years ago. The Mississippi changed from a braided to a meandering pattern beginning at its mouth at approximately 12,000 years ago (Saucier 1981:15; 1974:20; 1968:75). By 9000 years ago the meandering pattern had moved upstream to the Yazoo Basin in the central part of the state of Mississippi, and by 4000 to 6000 years ago had progressed north of the project area. Although a relict Mississippi meander belt has been identified in the western part of the Eastern Lowlands south of Marked Tree, Arkansas (south of the project area), it appears that the present Mississippi meander belt in the project area (east of the project sites) is about the same as that established at 4000 to 6000 years ago. The project area was thus not eroded by the present meander belt of the Mississippi, and its landforms are dominated by braided stream channels, levees, terraces, backswamps, and associated dunes. Before we discuss these landforms in the project area, we present a discussion of the geomorphological processes that formed and modified them.

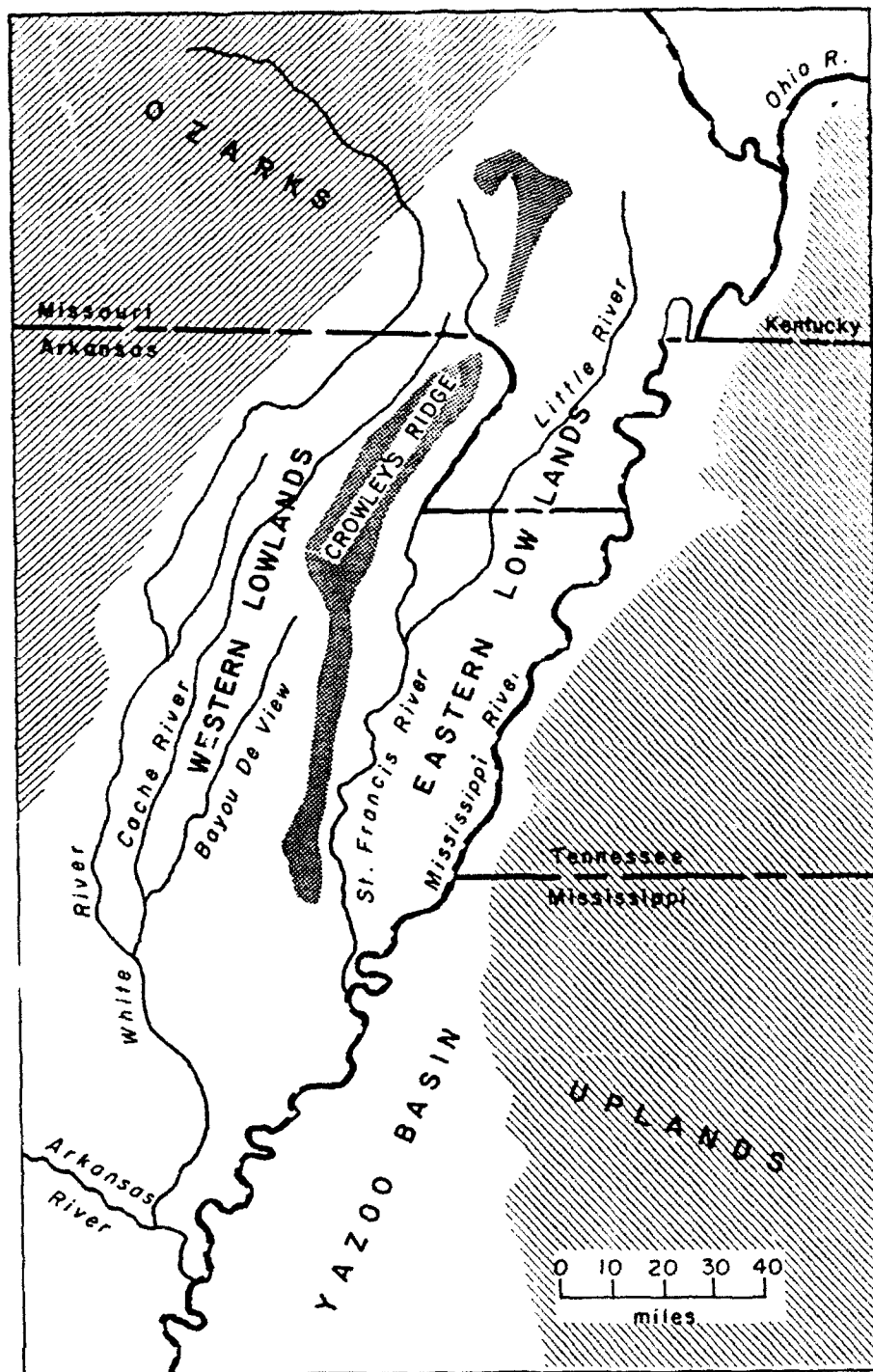


Figure 4-1. Major Physiographic Provinces of the Project Region.

Geomorphological Processes

Meandering Streams

As can be seen in the archaeological literature of the lower Mississippi Valley and in the Eastern Lowlands, the development of stream meanders are important to the understanding of prehistoric and historic settlement systems. The flood plain of the Mississippi River is one of the largest in the world; it includes relict meander scars, sloughs, lakes, and numerous smaller streams. As previously noted, the area has been extensively studied by both geologists and archaeologists.

Rivers are seldom straight, even if the banks of a river are straight along a map. The actual flow of the water normally winds from side to side due to the mechanical properties of moving water and the stream banks. This winding flow is the thalweg, the line which marks the deepest points along a stream channel, and can be interpreted as the basis for an initiation of meandering.

While a meandering pattern is frequent along many streams there is no complete agreement on the causes of meandering. Schulits (1941) defines gradient as the cause of meandering. Gradient or slope was felt to be a function of the size of grains comprising the bed, and meandering occurred as the stream adjusted its slope to the material it must carry. Schumm (1963) suggests that meandering may result when a large amount of the sediment load is carried as suspended load. Russell (1936) suggested that meanders begin along points of a river where the banks are more susceptible to erosion by water turbulence. Friedkin (1945), based upon flume experiments, agreed with Russell. Local erosion of the channel banks precipitated meandering. Using different material in his flume, Friedkin found that with more resistant fine material, the gradient was gentle and the channel deep. With coarse material, banks were easily eroded. Channels which were wide and shallow, with a steep gradient, tended to form a braided stream pattern.

The development of a meandering regime is probably the result of all the above variables, and not any single factor. Once the initial meander bend emerges, it progresses through a series of developmental stages. Sternberg (1956) describes the sequence for False River, Louisiana. Basically, turbulence is greater along the outer bank (cut bank) and less on the inner bank (point bar). This flow pattern causes material eroded from the cut bank to be deposited on the point bar of the next meander downstream, leading to downstream migration of meander loops. Cut bank erosion can be rapid, but it is also possible to predict with some accuracy the rate and direction of the migration of meanders. As the curvature of the meander becomes greater, the channel increasingly draws outward from its original position. In an advanced stage of this development the arms of the meander begin to converge, forming a loop.

The river follows this meander during normal flow conditions, but the distance across the neck of the forming loop decreases. During periods of high water the neck is subject to erosion and a chute develops between the two arms. Flow increases through the chute during flood episodes, until an approximate equilibrium of flow is reached between the meander loop and the neck chute. Since stream gradient is slightly increased through the chute, a slight reduction in flow in the loop occurs, resulting in increased deposition there. This, in turn, acts to increase chute flow and the loop ultimately becomes severed, forming an oxbow lake and eventually a filled, relict meander scar.

What is important for the archaeologist is that potential sources for habitation and exploitation result from the development of meander. Resources within this hydrologic regime are potentially very high. Fluctuating water levels typical of oxbow lakes promote high aquatic productivity (Lantz 1974). This is because the lake is periodically replenished by nutrients in overbank flooding or by the nominal amount of water entering the lake before the chute cut-off is complete. Aquatic production of an oxbow would tend to be at maximum just before and after the final chute cut-off.

Terrestrial environments related to an oxbow lake also support high wildlife populations (Gregory 1965). Yancy (1969) suggests this is due to high soil fertility. Nutrient-rich soils are produced by overbank deposits which allow for plant growth. Forest succession would typically be from stands of willows in the wetter areas to mixed oak-hickory hardwoods as the oxbow filled. In this nutrient-rich terrestrial environment animal populations can be expected to be very high.

Development of the flood plain is also critical in a meandering regime. Vertical accretion is critical to flood plain development. It is generally thought that both the river bed and the flood plain are built up as the result of flood activity. Schumm and Lichty (1963) attribute flood plain growth specifically to the establishment of vegetation. This has the effect of stabilizing the flood plain, and aids in preventing erosion. With climatic patterns conducive to abundant rainfall, continued overbank deposits and vegetation growth promote stable flood plain development. Schumm and Lichty (1963) further found that periods of drought tended to destroy flood plain growth by erosion. Grasses growing on the flood plain appeared not to be a significant factor in preventing flood plain erosion; the critical factor in promoting flood plain stability and growth seemed to be the presence of shrubs and trees.

As evidenced by the preceding discussions, the development of geomorphological processes and their chronology has become increasingly interdependent with studies of archaeological settlement pattern and chronology. A flood plain environment enriched by moist-climatic conditions and subject to a meandering regime becomes a highly exploitable area conducive to long and short term habitation in predictable areas.

Numerous studies have linked archaeological sites to the relict meanders of the Mississippi River. Only a few, however, have attempted to relate cultural historic site data to the development of a single oxbow or meander loop. Weinstein and Glander (1979) attempted to relate settlement pattern to the resource potential and diversity within the Swan Lake oxbow in the Yazoo Basin in central Mississippi. As previously discussed, there are four general stages in the development of a meander to a full oxbow: (1) active river, (2) transition, (3) oxbow lake and (4) filled-in lake (relict channel). Weinstein and Glander showed that as the developing oxbow moved through a series of stages, so did site development. The period of active water (Stage 1) was shown to be generally unfavorable for prolonged occupation because of bankline erosion. The greatest peak of resource potential and site development occurred after cut-off by the river, the third stage of development. The approaching fourth stage produced a more limited economic offering, and site occupation subsequently decreased.

Braided Streams

A braided stream is characterized basically by numerous sand bars and a general instability of channel walls. Unlike a meandering river, there is a general aggradation of the channel bed which causes the channel to become shallow and wide. Typically, a mid-channel bar is deposited in the shallow bed. The upstream end becomes vegetated and stabilized while the lower end continues to grow by the accretion of finer sediments. The stream is deflected around the bar to begin the same process over again on the downstream end of the bar or even in the deflected arms of the stream, depending, in large part, on the amount of load. The height of the bar is no greater than the height of the highest flood. The bars, unless heavily vegetated, tend to migrate downstream from erosion during floods.

Bank line stability is dependent on the behavior of the river bed during the rise of flood waters and their subsequent fall. A lateral migration of several hundred feet in a braided channel is not uncommon. Unlike a meandering river, where meander migrations are fairly predictable, migration of a braided channel is nearly impossible to predict. This is because significant scour takes place on only one bank (cut bank) in a meander. The other bank then becomes the site of deposition. In a braided channel this type of cut and fill does not occur. Frequently both banks may experience deposition or erosion at the same time.

This is the basic difference between meanders and sinuous braids. In an active meander the channel is deep and the cut bank is always in active retreat. The point bar is always being aggraded. With a braided pattern, what might be referred to as meanders are not necessarily retreating. In many cases, deposition similar to point bars is in active retreat. This is caused by cuts across deposited material which look similar to cut-offs or chutes of a meandering channel. The difference in a braided situation, however, is that these chutes are functional during low water stages; in a meandering channel they are not.

Like meandering, there is no complete agreement as to the causes of braiding. Part of the problem may lie in the fact that many streams exhibit both braided and meandering patterns along different reaches.

A number of different factors may cause braiding. Probably the most significant factors are erosion, discharge, and load. Fisk (1943:46) suggested that a river would braid or meander depending upon the type of sediment through which it flowed. Braiding tended to develop with easily eroded banks, principally sand or gravels. He also attributed braiding to a large sediment load. Freidkin (1945) in his flume experiments produced braiding because of rapid erosion of the banks. Mackin (1956) also related bank erosion to braiding. More specifically, at least in the example cited by Mackin, the presence or absence of vegetation (forest cover) was the key to braiding. Where banks were covered by prairie grasses, a braided pattern developed; where the banks were stabilized by forests, a meandering pattern developed.

Douglas (1951) noted that large and sudden variations in runoff contributed to braiding. A stable runoff tended to produce a meandering regime. Russell (1939), agreeing with Fisk, stated that braiding was caused by the amount of load carried by a stream. A large load in relation to carrying capacity created a braided regime; a small load, a meandering regime. Hjulstrom (1952), Rubey (1952) and Fahnestock (1963) came to basically the same conclusion.

Fahnestock (1963), in a study of a glacial braided stream near Mount Ranier, suggested that it is the amount of bed load that is the most significant contributing factor in the development of braiding when it is combined with the presence of highly erosive banks. Observations of this same stream also suggest that glacial advance or retreat does not affect the entire river, only an area close to the glacial terminus.

According to Fahnestock (1963:60) the effect of a glacial stream on the valley train is a function of the amount of water released by glacial melt rather than a function of load from the glacier. What this suggests is that most of the sediment load is derived by erosion downstream from the glacier, and not the valley train or glacier itself. Fahnestock also noted that in some instances the channel pattern of the White River (Washington state) changed from a meandering to braided pattern at the onset of higher summer discharges. During the winter the river returned to a meandering pattern. This suggests that the long term effect of the discharge of glacial meltwater is not as critical when compared to the short term effects of weather and run off. Both affect deposition and erosion. In moist periods a braided stream would tend to increase its braiding because of increased sediment load.

A similar conclusion was reached by Coleman (1969). In a study of the alluvial braided Brahmaputra there was also a seasonal variability of channel shifting. This shifting of channels was most pronounced during the rising and falling stages of the river.

Oversimplistically, it can be concluded that the meandering pattern typical of many streams reflects a fairly stable flood plain environment. Erosion is confined to lateral cutting of a single stream bank. Deposition occurs on the opposite bank. Periodic overbank flooding produces additional flood plain stability by adding nutrients to developing flora and fauna. It also builds up levee systems and produces an area or areas suitable for prolonged habitation and exploitation.

Braided stream flood plains are less stable. Because of increased bed load and consequent deposition within the channel(s), flood plains would be subjected to more frequent dissection. This erosion would tend to be far more irregular in form because both banks are equally subjected to erosion or deposition. This would tend to affect the succession of vegetation in a manner not typical of a meandering pattern. Essentially, the succession would not be able to develop fully because of the generally transitory nature of braided channels. Continued aggradation of a braided stream may also enhance flooding which, if too frequent, does not stabilize a flood plain environment, but erodes it. Plant succession has little time for development.

Like a meandering flood plain environment, an active braided pattern would be conducive to seasonal exploitation. Unlike a meandering flood plain, however, prolonged habitation would be difficult.

In summary, a meandering regime produces a stable environment suitable for normal succession of plant development, predictable site occupation and site development. A braided regime presents a less favorable environmental setting for plant succession and site occupation. Exploitable resources are available to both environments, but the full range of plants and animals expected in a meandering regime would not be found in the more unstable braiding pattern. This certainly does not imply that braided stream channels are uninhabitable. In the Eastern Lowlands, the low, unstable levees of braided streams were probably the most favorable locations for some distance. Furthermore, when a braided stream channel was cut off or abandoned, the low levee may have been even more favorable for habitation (like a filling oxbow lake) because of the decreased instability of the levee.

Seismic Activity - The New Madrid Earthquake

A major earthquake, thought to have been one of the most severe in recorded history, struck the St. Francis Basin area on December 16, 1811. Actually, the earthquake was a series of major and minor shocks extending from the first shock in 1811 to at least December, 1812. Two other major shocks took place after the December, 1811 event. These occurred on January 23, 1812 and again on February 7, 1812. Relying on post-earthquake event data, the magnitude of the three successive events is thought to be about 8.5 on the Richter scale or even higher (Epoley 1965).

The significance of this major geologic event is important for two reasons. First, there is the question of effects on local geology. Second, there is the question of effects on archaeological data. The following paragraphs attempt to summarize what is known of the effects of the earthquake regarding these two problem areas.

There can be a little doubt that the immediate effects were devastating to portions of the study area. Had the area been intensely populated the damage would have been much worse (we might also have better records of the event). Stream bank collapse, levee breaks, islands disappearing and others appearing are prominent in the accounts of people on or near rivers. Reelfoot Lake in western Tennessee is one of the more significant features thought to have been created by subsidence resulting from the earthquake. Severe earth waving (similar to waves on the surface of a large body of water), fissuring, faulting, and water and sediment extrusions were also common to the area. Of these, sand blows are the most easily identified and are prominent features on sites 3MS346, 3MS351, and 3CG847.

Probably the most significant feature of northeast Arkansas attributed to the event are the "Sunk Lands" (Fuller 1912:64-75) (Fig. 4-2). The Sunk Lands allegedly resulted from the warping of alluvial deposits. Saucier (1970), however, casts considerable doubt over this origin of the Sunk Lands. He hypothesizes that these features resulted from the alluvial drowning of relict braided stream channels by a Mississippi River crevasse channel about 1000-1500 years ago. Natural levees formed along Left Hand Chute provided the mechanism for formation of the Sunk Lands by intercepting the St. Francis River and cutting off southward drainage patterns. This resulted in pronounced alluvial drowning of the so-called Sunk Lands.

According to Saucier's hypothesis Big Lake was formed in this manner. The time in which this feature originated is critical to the development of settlement pattern hypotheses developed for the Woodland and Mississippian occupations in the St. Francis Basin. Morse (1980a) hypothesizes that the reason for the Zebree site location is the inducement caused by the creation of Big Lake some 1000 to 1500 years ago. The Big Lake Phase (Early Mississippi) is hypothesized by Morse to have been a southward migration from environmental model, such inducement of population shift could not have occurred until recent historic times.

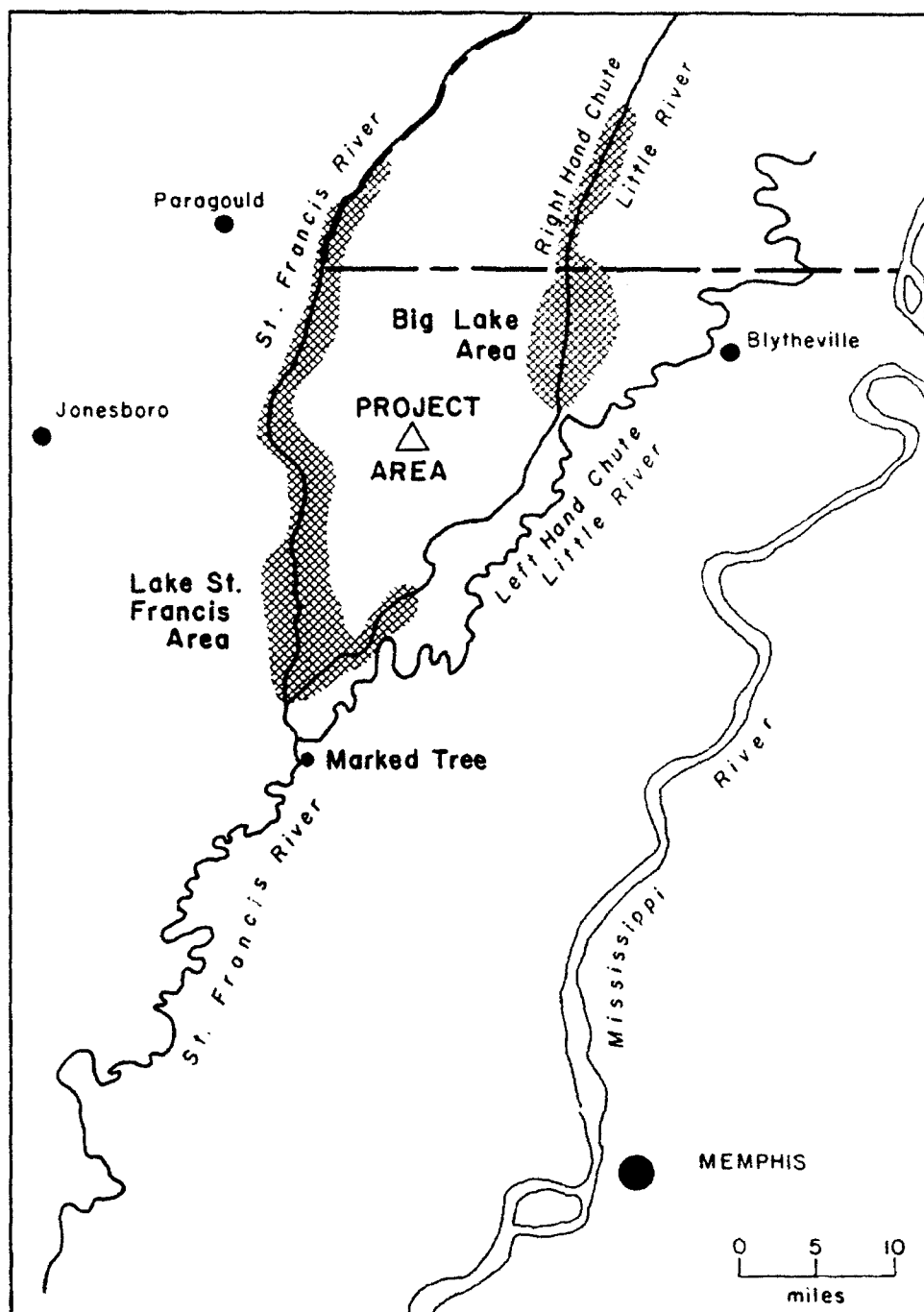


Figure 4-2. "Sunk Lands" in Northeast Arkansas, along the St. Francis River and the Right Hand Chute of Little River (indicated by crosshatching).

The data from Zebree largely support the Saucier hypothesis for the origin of the Sunk Lands and consequently Big Lake. There are, however, some discrepancies in the data which argue for the formation of the Sunk Lands as proposed by Fuller (1912). Pollen analysis of Big Lake sediments from the Zebree site area show only recent deposits dating back to the time of the earthquake. Unfortunately deep pollen cores (170 cm and below) could not be taken, and it is hypothesized by King (1980) that the sediments sampled were influxes of sands and silts overlying the older lake bed as a result of the earthquake.

Microenvironments

Natural Levees

Natural levees develop as annual water-level rise causes overbank flooding and deposition. As fast moving flood waters begin to pass over the bank, they slow down. This slowing results in decreased load carrying capacity and consequent immediate sediment deposition. The portion of the flood plain closest to the active channel first experiences the flood water velocity drop off; it soon becomes the highest location in the flood plain and contains coarse sediments. Toward the outer edges of the levee the sediments become finer and lower. With continued flooding, the building levees become the highest terrain in the alluvial valley. As such they become potential areas of habitation. Site 3MS351 is an example of a site located on a natural levee of a relict braided channel.

Crevasse Channel Levees

The cutbank side of a meander is subject to periodic episodes of intense river scouring. This normally takes place during periods of high water. As a result, a meandering river frequently truncates its own natural levee, forming a crevasse channel. Depending upon the duration and frequency of flood episodes a crevasse channel may be kept open indefinitely, eventually forming a new river channel diversion. Similar to the main stream, relatively firm natural levees form along the new crevasse and new habitation possibilities are developed. The Zebree site (3MS20) is a possible example of this type of site location.

Backswamp Drainage Areas

Another area of potential habitation is on the banks of minor streams draining the lower backswamp areas between the natural levees. These streams flow into the major rivers but would create some minor relief by way of their own natural levees. These minor levees would be less desirable than those along the higher crevasse or main river channels because they were subject to more frequent flooding. However, for a relatively short seasonal occupation these levees would have been suitable.

Sand Dunes

Dune fields are present in both the Western and Eastern Lowlands. In the Western Lowlands they flank relict braided channels which carried glacial outwash of the waxing Late Wisconsin. Those in the Eastern Lowlands (remnants mapped in the vicinity of Sikeston, Missouri) are younger and are a result of outwash during waning stages of Late Wisconsin glaciation. The optimum time for sand dune development is thought to have been between 18,000 and 22,000 years B.P. (Saucier 1978:23, 37), although some dunes in the Eastern Lowlands may be as young as 6000 - 10,000 years B.P. (Saucier 1974).

Dunes in the Western Lowlands occur on mid-channel bars or islands, and the flanks of the channel. This implies that dunes were created by material transported by wind from braided channels while they were carrying outwash. Evidence for formation of dunes in the Eastern Lowlands is not as conclusive. Saucier (1978:31-32) believes dunes there originated similarly, although formation occurred over a shorter period of time.

Dune fields have been used as areas for habitation since Paleo-Indian times, although it has not yet been determined if there are any trends relating to dune occupation and cultural period. Nor is it clear if there are any trends relating to preferential occupation of certain dune fields. The Sloan site (3GE94), possibly the Lace (3P017) and Brand (3P0139) sites, and sites 3MS346 and 3CG847 of this project are examples of sites located on dunes.

Soil Morphology

The soils at the archaeological sites along the Buffalo Diversion Project near Leachville, Arkansas (Mississippi and Craighead Counties) are developed mainly in alluvium deposited by the Mississippi River. In addition to the direct deposition of alluvium, some reworking of materials and deposition by wind have also occurred. A major factor in the genesis of soils in the area was the activity of the New Madrid earthquake of 1811. The disruption of certain profiles and the extrusion and deposition of underlying sands are common. Thus, the area is extremely complex as a result of the sedimentation pattern, eolian deposition, agricultural activity, and the influence of the New Madrid earthquake of 1811.

Figure 4-3 shows the major soil associations in the study area. Association 1 includes the Amagon-Dundee-Crevasse soil series. These soils are derived from alluvium and range from poorly to excessively drained. The Amagon and Dundee soils are fine silty, while the Crevasse series has sandy textures. Table 4-1 summarizes the general characteristics and classification of the major soils mapped in the study area (Ferguson 1979; and Ferguson and Gray 1971).

The relief in the study area is minor. The area is mainly a broad flat. A few swales are evident, but relief differences are usually less than 40 cm. Some modification of the landscape probably took place during the earthquake of 1811. Detailed discussion of site soils and paleoenvironmental inferences are presented in the site discussion chapters.

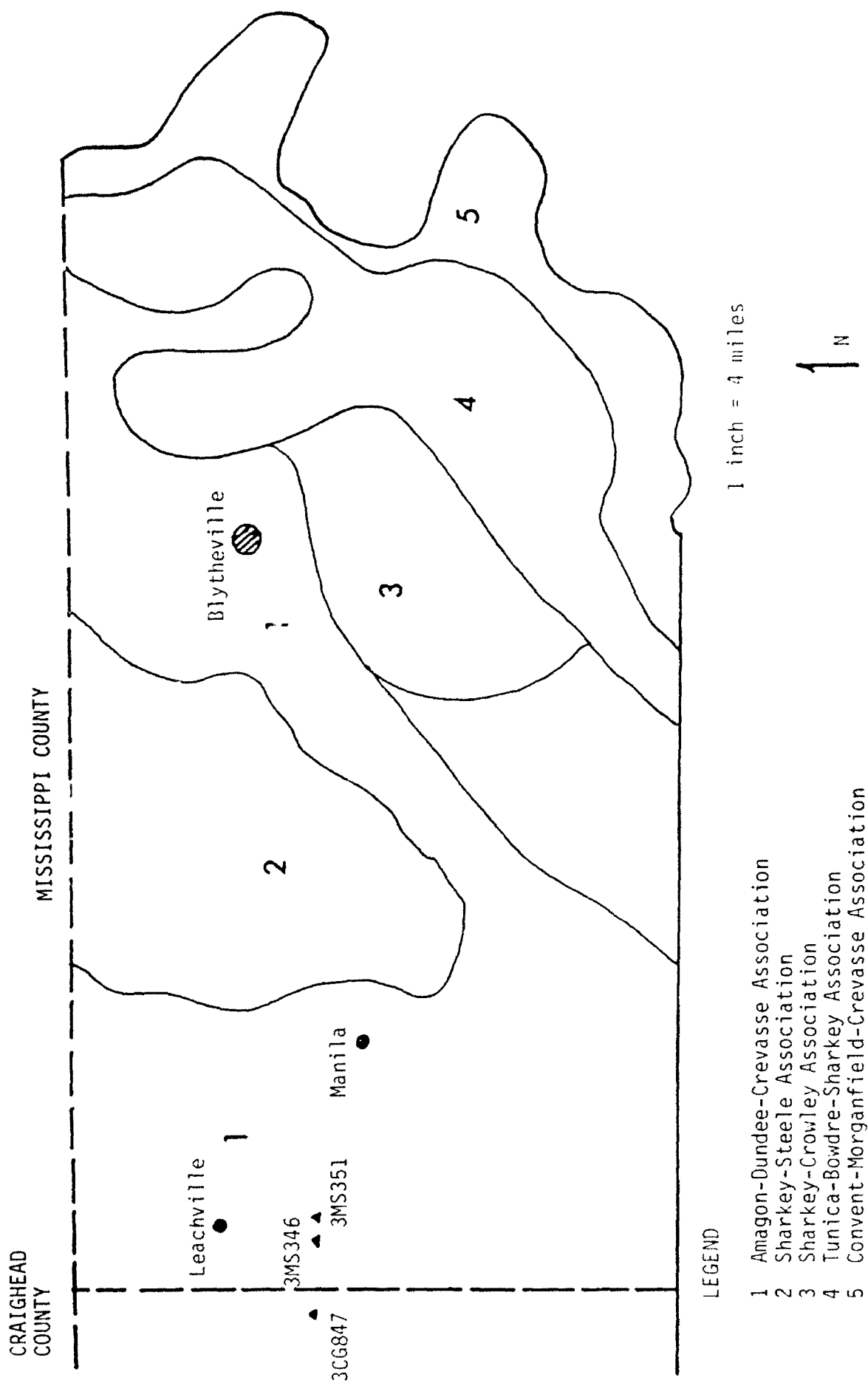


Figure 4-3. Site locations and soil associations of a portion of Craighead and Mississippi counties, Arkansas (after Ferguson, 1979 and Ferguson and Gray, 1971).

Table 4-1. Description of soil series in study area
(after Ferguson, 1979; Ferguson and Gray, 1971).

Soil Assoc.	Soil Series	Texture	Drainage	Classification
1	Amagon	Fine silty	Poorly	Vertic Haplaquepts
4	Bowdre	Clayey/loamy	Mod. well	Aquic Fluventic Hapludoll
1,5	Crevasse	Sandy	Excessive	Typic Udipsamments
3	Crowley	Fine	Poorly	Typic Albaqualfs
5	Convent	Coarse silty	SW Poorly	Aeric Haplaquepts
1	Dundee	Fine silty	SW Poorly	Aeric Ochraqualfs
5	Morganfield	Coarse silty	Well	Typic Udifluvents
2,3,4	Sharkey	Very fine	Poorly	Vertic Haplaquepts
2	Steele	Sandy/clayey	Mod. well	Aquic Udifluvents
4	Tunica	Clayey/loamy	Poorly	Vertic Haplaquepts

CHAPTER 5

BIOTIC ENVIRONMENT

Introduction

The Buffalo Creek Diversion Project is located within the Mississippi Alluvial Valley of the Gulf Coastal Plain Physiographic Province. Fifty miles to the east of the project area the Loess Blufflands rise above the flood plain of the Mississippi River giving way to an upland topography. Twenty miles to the west of Buffalo Creek, Crowley's Ridge, an upland Tertiary erosional remnant, divides the Mississippi Alluvial Valley into an eastern and western lowlands section. The geology of Crowley's Ridge is essentially identical to the Blufflands to the east. Beyond the Western Lowlands, west and north of Crowley's Ridge, is the eastern escarpment of the Ozark upland province. While the project site is situated within only one of these physiographic areas, its proximity to the others necessitates the inclusion of all of them in a discussion of biotic environments.

The differences in topography and climate between the above mentioned regions results in comparatively unique biotic compositions that are regionally diverse and complex. It is conceivable that this diversity was in the past important in structuring the behavior of human groups occupying the Arkansas lowlands. An understanding of this situation is therefore deemed necessary to interpret the prehistory of this region. The spatial range of various cultural groups in the area is difficult to ascertain. However, it would seem that some articulation with physiographic regions adjacent to the Arkansas lowlands did occur in the past. This is most readily apparent when procurement of lithic raw materials is considered. While procurement of this abiotic resource may have at times occurred through trade rather than direct exploitation, the importance of the upland provinces is not lessened. The biotic resources in these areas might also have been important elements of human behavioral systems.

The following discussion examines the recent biotic composition of the Arkansas lowlands and adjacent physiographic areas. While this discussion is not meant to be strictly applicable to interpretations before the historic period, the degrees of environmental diversity evident today may have been present in the past as well. Upland terrain, drainage patterns and soils are generally not very conducive to rapid change. Since these are major determinants in biotic diversification it is probable that similar variation in biota among these areas existed in the past as they do today. Figure 5-1 illustrates the major biotic and physiographic regions considered within the following discussion.

Ozark Plateau

The western border of the Mississippi alluvial valley in Arkansas is formed by the eastern escarpment of the Ozark Plateau Province. Sections within this province that are adjacent to the northeast portion of the Western Lowlands includes the Boston Mountains, the Springfield Plateau, and the Salem Plateau. Numerous streams and rivers drain this region, flowing southward and eastward into the Mississippi Alluvial Valley. Major rivers in this region accessible from the lowlands include the White, Little Red, Current, and Black. These form steep, narrow valleys in the interior of the plateau usually becoming wider near the eastern escarpment. Terrain varies throughout the region from broad, low plateaus with rolling hills to jagged,

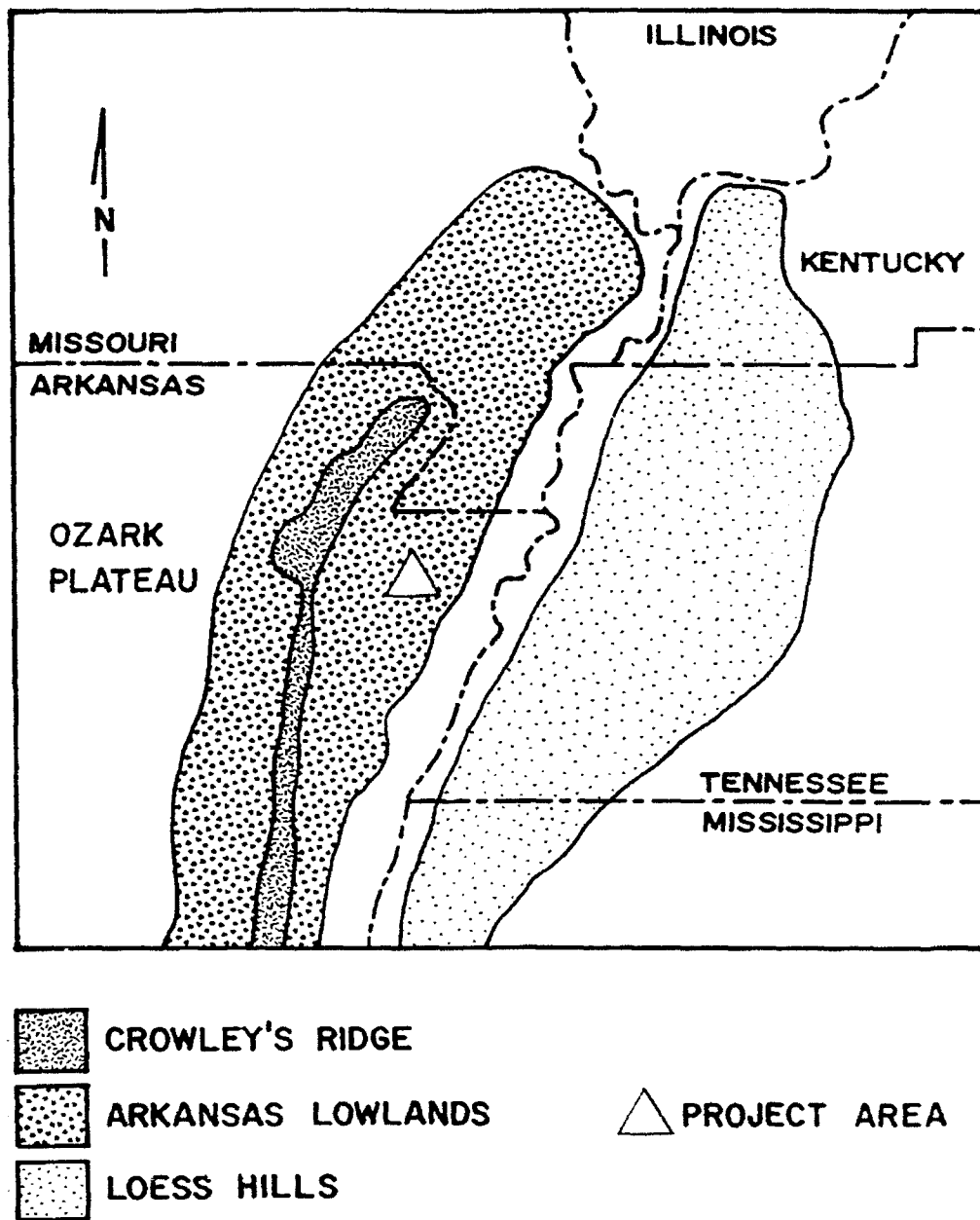


Figure 5-1. Map of project region showing major physiographic/biotic areas discussed in the text: Ozark Plateau, Loess Hills, Crowley's Ridge, Arkansas Lowlands.

abrupt ridges interrupted by stream dissections and valleys. The soils in the upland region are primarily formed on parent materials of chert, limestone, and dolomite although along the eastern edge of the province a thin loess mantle covers the escarpment (Thornbury 1965; Price and Krakker 1975; Braun 1975).

An environmental inventory of the Big Mulberry Creek Watershed in the Boston Mountains section of the Ozark Province gives the following description of the flora in that region:

. . .the known flora of the study area is quire diverse. It consists of approximately 135 species of flowering herbaceous plants, 120 species of woody plants, and 35 kinds of ferns, horsetails, and the like. If grasses, algae, 70 species of Bryophytes including 20 species of lichens, liverworts, and 9 species of mosses are included, the list would exceed 700. Add to this the numerous fungi, and the botanical inventory becomes impressively large and diverse. This variety is due to the elevation ranging from about 500 feet to approximately 2,600 feet, a relief of about 2,100 feet in this predominantly upland hardwood forest. The variety of soils and the range of moisture and exposure also add to the ecological diversity of the area (U.S. Army Corps of Engineers 1973:24).

Steyermark notes that many plants are very restricted in their distribution and attributes this to diversities in climate and drainage.

Such micro-climates or edaphic conditions, . . .are the key to the diversity of the geographical distributional pattern within the Ozark Region . . .and help to explain many of the variations of the flora. Thus, the north-facing slopes afford the relatively cooler, damper, and shadier habitats required for the survival of plants adapted to a cool, moist, shaded, root run. Contrariwise, the sunny, exposed rock exposures in the form of glades on south- or west-facing situations afford a habitat for the species demanding such a combination (Steyermark 1959:99-100).

Braun includes the flora of the Ozark Plateau within the Southern Division of the Oak-Hickory Forest Region. As the name implies, oak and hickory are well represented throughout the region. Yellow pine (Pinus echinata) may co-dominate with oak in some areas. "Some phase of oak-hickory or oak-pine forest prevails over most of the Ozark Upland, but in such an area of diverse topography more xeric or more mesic communities are not uncommon" (Braun 1975:166).

On well drained uplands and southern exposures blackjack oak (Quercus marilandica) and post oak (Quercus stellata) commonly dominate the forest canopy. These often occur together with Pinus echinata (Braun 1975:166-167; Moore 1960:6). Steyermark suggests that Pinus echinata is restricted in its distribution by soil factors and tends to flourish best on strongly acidic soil (Steyermark 1959:95, 120). Chinquapin (Castanea ozarkensis), black or sourgum (Nyssa sylvatica), black hickory (Carya texana), and winged elm (Ulmus alata) are found in dry upland habitat (U.S. Corps of Engineers 1973:24). On well drained ridge top soils, undergrowth may include, "little bluestem, blackseed, needlegrass, indiagrass, bleeked panicum, low panicum, long leaf unifol and tall dropseed" (Padgett 1976:16). As Padgett indicates, these ground level plants provide prime food-resources for many animal species. Other understory species common in the well drained uplands includes blueberry (Vaccinium sp.), sweet-scented sumac (Rhus aromatica), red root (Ceanothus americanus), St. Andrew's cross (Ascyrum hypericoides), wild daisies (Aster patens, A. Linariifolius), and beggarweed (Desmodium rotundifolium) (Braun 1975:167-168).

Moore (1960) notes that the northern slopes, which are generally shaded, cooler, and moister tend to possess communities somewhat different from the southern slopes and ridge tops. White oak (Quercus alba) tends to dominate these mesic slopes and may be accompanied by understory trees including dogwood (Cornus), redbud (Cercis canadensis), hornbeam (Ostrya virginiana), ironwood (Carpinus caroliniana), Red mulberry (Morus rubra), downy junberry (Amelanchier arborea), pawpaw (Asimina triloba), and woolly bumelia (Bumelia lanuginosa) (Braun 1975:168). The herbaceous layer in this forest community includes "Smilacina racemosa, Uvularia grandiflora, Geranium maculatum, Sedum ternatum, Passiflora lutea, Cynoglossum virginianum, Soliduge caesia and Eupatorium regosum" (Braun 1975:168). Another source lists the following trees as prominent members of the more mesic upland community: Northern red oak (Quercus borealis), white oak, mockernut hickory (Carya tomentosa), black hickory, white hickory (Carya alba), flowering dogwood, white ash (Fraxinus americana), service berry (Amelanchier arborea) and red maple as primary constituents. Forest floor species include such shrubs and vines as hazelbrush (Corylus americana), buckbrush (Symphoricarpos orbiculatus) and virginia creeper (Parthenocissus quinquefolia). Herbaceous plants include richweed (Pilea pumila), wildyam (Dioscorea villosa), bed straw (Galium spp.), and hog peanut (Amphicarps bracteata) (U.S. Army Corps of Engineers 1973).

Another mesic slope association found in the eastern Ozark Province is dominated by oaks and sugar maple and is quite distinct from the predominant oak-hickory forest. "Sugar maple is a constituent of many slope forests, particularly on limestone soils, where it may be associated with white oak, red oak, chinquapin oak, basswood, and butternut hickory. These more mesophytic slope forests have a rich and luxuriant undergrowth resembling that of mesophytic forests farther east" (Braun 1975:168).

Xerophytic communities occur in areas that are rocky or excessively drained. Braun (1975) notes that red cedar (Juniperus virginiana) is the main tree species in these areas and is accompanied by xerophytic herbaceous plants. Some researchers consider the frequent occurrence of red cedar to be a recent phenomena and suggest that it is a secondary growth pioneer species, conducive to growth in areas free of shade. Steyermark (1959:71-77) associates them with an edaphic subclimax vegetation that is most obvious in the "glades" and "balds" of the Ozark uplands. He suggests that these highly xerophytic communities have been present in this region for a considerable period of time. Although trees other than Juniperus virginiana are infrequent in these xerophytic communities, they do occur. Post oak, black oak, blackjack oak, winged elm, persimmon and sparkleberry (Vaccinium arborium) are minor constituents of this community. In the herbaceous layer, xeric plants include aster (Aster spp.) goldenrod (Solidago spp.), rabbit tobacco (Antennaria plantaginifolia), panic grass (Panicum sp.), beggarweed (Desmodium canescens), little bluestem (Andropogon scoparius), sumac (Rhus copallina), greenbrier (Smitax Gonanox) and sweet sumac (Rhus aromatica) (U.S. Army Corps of Engineers 1973).

In the moister valleys a mixed forest community may be present. Braun notes that the "Lowlands of the region . . . support stages of hydrach successions leading to the establishment of an Acer saccharum-Carya cordiformis" association (1975:169). Included within this maple-hickory community is blue beech (Carpinus caroliniana), box elder (Acer negundo), green ash (Fraxinum pennsylvanica), white ash (Fraxinum americana), American elm (Ulmus americana), hackberry (Celtis laevigata), and red bud (Cercis canadensis). Species of trees found along gravel bars and small streams in the uplands are black willow (Salix nigra), river birch (Betula nigra) and sycamore (Platanus occidentalis). Woody plants are numerous including such shrubs as witch hazel (Hamamelis virginiana), locust (Amorpha fruticosa), spice bush (Lindera bezoin), and pawpaw (Asimina triloba). Common herbs consist of sedge (Cyperus sp.), bedstraw (Galium sp.), smartweed (Polygonum sp.) and rush (Duncus sp.) (U.S. Army Corps of Engineers 1973; Braun 1975).

Several rivers emerge from the eastern edge of the Ozark Province and drain into the Arkansas Lowlands. These streams generally occupy narrow, steep-sided gorges and valleys in the Ozark interior. As they approach the lowlands, the valleys tend to become considerably wider. These broad expanses of alluvial flood plain are inhabited by flora characteristic of the Southeastern Evergreen Forest found to the south and east of the Ozarks in the Mississippi Valley. These "tongues" of Southeastern Evergreen Forest contrast sharply with the upland oak-hickory forest. The composition of this flood plain forest is essentially identical to that described for the Arkansas Lowlands (Braun 1975:168; Hoffman 1970:140).

Fauna in the Ozark Province were diverse and abundant prior to settlement. An inventory of animals in the Big Mulberry Creek Watershed, however, still noted 57 species of fish, 27 mammals and 197 species of birds. Of the bird species, 36 are year-round residents. Major fish genera listed were drum (Aplodinotus), crappie (Pomoxis), bass (Micropterus), sunfish (Lepomis), catfish (Pylodictis and Ictalurus), buffalo (Ictiobus), shiner (Notropis) and gar (Lepisosteus). Mammals recorded by the inventory included black bear (Ursus americanus), striped skunk (Mephitis mephitis), American beaver (Castor canadensis), bobcat (Lynx rufus), red fox (Vulpes vulpes), gray fox (Urocyon cinereoargenteus), otter (Lutra canadensis), opossum (Didelphis virginiana), raccoon (Procyon lotor), white tailed deer (Odocoileus virginianus), cottontail (Sylvilagus floridanus) and several genera of squirrels (U.S. Army Corps of Engineers 1973).

Loess Hills

Approximately 40 miles east of the Buffalo Creek project area, on the east side of the Mississippi River, is an area of extensive loess deposits commonly called the "Blufflands." Delcourt and Delcourt (1975:386, 387) describe this physiographic feature as,

a 10-to-25 mile wide belt of hilly land bordering the eastern escarpment of the Mississippi River alluvial valley, extending roughly north-south from the confluence of the Ohio and Mississippi Rivers to southeastern Louisiana . . . The Bluff land belt coincides with the thickest deposits of loess in the Tennessee-Mississippi-Louisiana area. The loess, which ranges from a few feet to as much as 200 ft. thick, mantles upland surfaces along the eastern margin of the Mississippi River alluvial valley. The loess blanket is thickest near the bluff edge (adjacent to the Mississippi flood plain) and thins sharply eastward.

The soils of the west Tennessee Blufflands consist of the Grenada-Memphis-Loring series which are moderate to well-drained loess deposits (Buntley n.d.:1). These soils are easily dissected by the numerous streams and rivers, tributaries to the Mississippi River, that flow south and west into the alluvial valley. Along the western margin of the loess belt the Mississippi River's eastward migration has steeply truncated these deposits forming high bluffs which divide the alluvial flood plain from the uplands. In some areas these bluffs are more than 200 feet high (Luther 1977:14).

Braun includes the Loess Hills vegetation within the Western Mesophytic Forest Region. She describes this forest region as follows:

This region is not characterized by a single climax type. The major vegetation types occurring in this region form a complex mosaic . . . The forests of the transition region are in general less luxuriant in aspect than are those of the Mixed Mesophytic Forest region (Braun:1975:122-123).

Lewis (1974:18) uses the term Beech-Tupelo Loess Hills to describe the vegetation of the Blufflands. He and Braun both note the prevalence of beech trees (Fagus glandifolia) which may comprise almost 50 percent of the represented species. Other important canopy species include tulip trees (Liriodendron tulipifera), red oak (Quercus borealis var. maxima), hickory (Carya sp.), magnolia (Magnolia acuminata), and blackgum (Nyssa sylvatica). (Braun 1975:160, Lewis 1974:18).

While the above constitute the majority of the upper canopy trees second story growth includes beech and tulip tree saplings and white oak (Quercus alba). Below these is a rich layer of herbaceous plants and shrubs including paw paw (Asimian trilaba), horn beam (Ostrya virginiana), hercules-club (Aralia spinosa), and other small woody plants. Vines, bamboo, or cane (Arundinaria gigantea) and several genera of ferns also comprise the forest floor vegetation (Braun 1975:160).

Animal species in this region are numerous and abundant. The fruit of the beech tree, which is more than plentiful in this region serves as an important food source for numerous mammals and birds. These include ruffed grouse (Bonasa umbellus), wild turkey (Meleagris gallopavo), black bear (Ursus americanus), racoon (Procyon lotor), gray fox (Urocyon cinereoargenteus), white tailed deer (Odocoileus virginianus), eastern cottontail (Sylvilagus floridanus), grey squirrel (Sciurus carolinensis) and opossum (Didelphis marsupialis) (Lewis 1974:19). Other mammals and birds once found in this region are prairie chicken (Tympanuchus cupido), passenger pigeon (Ectopistes migratorius), striped skunk (Mephitis mephitis), mountain lion (Felis concolor), and elk (Cervis canadensis) (Lewis 1974:19).

To the east, away from the Mississippi River, the loess thins out into a rolling upland region. The biota here fall under Lewis' Oak-Hickory Upland Forest. This area is still within the Western Mesophytic Forest Region described by Braun (1975). As the name implies Oak (primarily Quercus alba and Quercus falacata) and hickory (Carya sp.) tend to be the most abundant trees in this region. Overall, the area is similar to the Blufflands biota, although minor differences exist. One important difference which Lewis notes is that although the animals present in each area would be the same, they are more abundant in the oak-hickory upland forest (Lewis 1974:19).

Crowley's Ridge

Crowley's Ridge is a Tertiary remnant in the Lower Mississippi alluvial valley. The Tertiary deposits are primarily gravels which are overlain by a mantle of Pleistocene loess. Relief between Crowley's Ridge and the adjacent Eastern Lowlands alluvial flood plain varies but is generally about 120 feet (Ferguson 1979; Call 1891:xiii).

Braun considers the vegetation of Crowley's Ridge to be similar to the Loess Hills flora. She notes that the sedimentary deposits are virtually identical to those east of the Mississippi River.

Although far removed from the loess hills on the east side of the Mississippi River, the forest vegetation of Crowley's Ridge is more like that to the east of the Mississippi than that in the Ozark upland to the west. Here is an outlier of mixed mesophytic forest, so situated that it cannot be included in the Western Mesophytic Forest region, although it is similar to the forest of the Western border of that region (Braun 1975:161).

In the annual reports of the Geological Survey of Arkansas, accounts of plant species were published in relation to geological features. Cucumber tree (Magnolia acuminata) was noted to be "abundant" on Crowley's Ridge as was holly (Ilex opaca). Black locust (Robinia pseudacacia) "is one of the most common trees of the open glades throughout the ridge" (Call 1891:188). Coffee bean (Gymnocladus canadensis), witch hazel (Hamamelis virginica), flowering dogwood (Cornus florida) and beech (Fagus sp.) were indicated to be common species on the slopes and summit of Crowley's Ridge. Shortleaved pine (Pinus mitis) was also noted as a common constituent (Call 1891:183-202).

The Arkansas Lowlands

Introduction

The northeast Arkansas Lowlands lie within the northern section of the Lower Mississippi Alluvial Valley and are part of the flood plain of the Mississippi River. Two major divisions are recognized, the Eastern and the Western Lowlands, separated by Crowley's Ridge. The Western Lowlands are composed mainly of recent Holocene alluvial deposits. Where Pleistocene deposits exist in the Eastern Lowlands they are in most cases covered by several meters of more recent alluvial material. Flooding is much more extensive to the east of Crowley's Ridge; in the western valley deposits of new alluvium are generally limited to the immediate flood plains of the White, Black, Cache and L'Anguille Rivers (Saucier 1974). In general, however, these two regions are physiographically similar and differences are in degrees rather than kind. Primarily, the terrain of the Eastern Lowlands is less stable and subject to alterations by erosion and deposition. In the Western Lowlands these processes are more restricted and much of the landscape is relatively stable. Both divisions of the lowlands, however, can be characterized by Braun's description of the physiography of the Lower Mississippi Alluvial Valley.

Alluviation in these valleys, which slowly tends to raise some parts of the bottomland above flood levels, and trenching of older deposits have resulted in the formation of "second bottoms", of low alluvial "ridges" in interstream areas in the bottoms, and of natural levees . . . the growth of natural levees near streams decreases the possibility of drainage in interstream bottomland areas, and often results in extensive interstream bottomland swamps and bayous.

The streams crossing the Coastal Plain are sluggish and generally carry a considerable amount of silt. In many cases, their mouths are obstructed by spits and bars, tending to increase the extent of swamp (Braun 1975:290-291).

The biota of the Western and Eastern Lowlands are more or less identical although the extent and age of some of the plant communities differs. Braun (1975) includes the forest of this region within the Southeastern Evergreen Forest Region. The dominant vegetation of this forest region is characterized by a mixture of evergreens and broad-leaved deciduous communities. Braun described this mixture as follows:

The vegetation of this region is in part warm temperate subtropical, in part distinctively coastal plain, and in part temperate deciduous. It is made up of a variety of widely different forest communities - coniferous, mixed coniferous and hardwood, deciduous hardwood, and mixed deciduous and broad-leaved evergreen hardwood-interrupted here and there by swamps, bogs, and prairie (Braun 1975:282).

Within the northeast Arkansas Lowlands, topographic relief plays an extremely important role in determining the distribution and composition of floral communities (Harris 1980:13-14; Minckler 1973:29). There is therefore a broad correlation between vegetative communities and flood plain physiographic features such as levees, sand bars, sloughs, flats, and swamps (Lewis 1974:17). In describing floral communities in this region Lewis (1974), Braun (1975), Shelford (1954) and others combine topographic nomenclature with the names of dominant plant species to emphasize this relationship. Hence community names such as "shrub-sized cottonwood-willow with bare silt area", "cottonwood-sycamore natural levee forest," and "cypress-tupelo backwater swamp," are common in the literature.

Braun's general description (1975) of bottomland forest includes three physiographic-floristic divisions: the cypress-tupelo swamp forest, the hardwood bottoms forest and the ridge bottoms forest. The swamp forest is essentially found in those areas where standing water is present during most of the year. As the name suggests water tupelo (Nyssa aquatica) and bald cypress (Taxodium distichum) are the most common hydric flora in this part of the flood plain. The Ridge Bottom forest is composed primarily of Sweetgum (Liquidambar styraciflua), various oaks (Quercus), shagbark hickory (Carya ovata), and pecan (Carya illinoensis). These trees dominate the vegetation on well-drained elevated land such as those areas formed by levee building. The hardwood bottoms are low lying areas between ridges and swamps that are consistently inundated but remain above water for much of the year. Braun (1975:293) notes that:

The hardwood bottoms forest of the Mississippi Valley consists of the following species, arranged in order of abundance: sweet (red) gum, red maple, swamp chestnut (cow) oak, swamp red oak, shingle oak, overcup oak, willow oak, elm, sassafras, hackberry (Celtis laevigata), pawpaw, dogwood, and Carpinus.

Except for sassafras (Sassafras albidum), all of the above mentioned trees are relatively tolerant of excessive water. According to Hall and Smith (1955), most of these trees, once they become established, can endure relatively prolonged periods of inundation before dying or becoming sickly. Some degree of water tolerance would be expected of most of the vegetation found in the flood plain habitats. This would be particularly the case in the Eastern Lowlands where even the well drained ridges are occasionally inundated during periods of extensive flooding. Water tolerance appears to be a decisive factor in the composition and distribution of plant communities in these areas.

While Braun has dealt with the flora in this region in a general fashion, other researchers have focused on more specific aspects of the vegetation. Of particular interest has been the concern with the complex patterns of plant and community succession within active flood plains. Flood plains of rivers, and particularly large rivers like the Mississippi, are extremely dynamic landscapes. Land surfaces are constantly being altered by processes of alluviation and erosion. In areas immediately adjacent to active flows of water, old land surfaces are constantly being obliterated as new ones are formed. The picture that emerges is of a rather unstable, constantly changing topography. Since, as previously noted, there is a strong correlation between variation in flood plain topography and vegetation it would seem that plant communities would likewise be subject to constant change. Therefore, with other variables held constant, it should be possible to model a series of interrelated topographic and vegetational stages of development or succession. The dependent relationships between these two environmental subsystems can be identified as processual agents such that feedback between them will invoke predictable responses.

Using the above concept the physiography of the Arkansas Lowlands can be broken down into meaningful units that may be correlated with different plant communities and stages of succession. Previous studies using similar concepts have been conducted by Harris (1980, 1981), Lewis (1974) and Shelford (1954) in this region. Figure 5-2 identifies the divisions discussed in this report. Much of the data for this discussion is derived from the above mentioned sources. A number of the divisions are slightly modified duplicates of ones developed by these authors.

Aquatic Habitats

Lewis (1974:27) defines a "rivers, bayous and open lakes biotic community" in the southeastern Missouri lowlands. He notes that the topography associated with this community once "covered a considerable expanse of the region prior to the extensive drainage projects initiated in the early decades of this century." Undoubtedly, this was also the case in northeastern Arkansas where extensive public and private drainage projects have virtually eliminated or restricted these aquatic conditions (see Harrison and Kollmorgen 1947; Harrison 1954; Simonson 1947; and Schultz 1968, for descriptions of these activities).

The "rivers, bayous, and open lakes" category discussed by Lewis could actually be broken down into two distinct habitats: conditions where water is stagnant and conditions where there is an active current. As Reid (1961:310) notes,

The communities of streams are under the influence of several major environmental features not encountered by lake inhabitants. One of the most important of these is current, including, as it were, the numerous hydrological processes related to stream flow . . . Current-created turbulence tends to maintain a relatively uniform set of physiochemical conditions . . . normally free from stratification such as found in lakes.

In the active flood plain of the Mississippi River, this segregation of aquatic environments may in many cases become very complex. Seasonal overflows into areas of standing water will tend to introduce elements of active flow into these stagnant water regions. It would seem then that organisms inhabiting these lakes, ponds, and sloughs would either be highly flexible or seasonally transitory.

Harris (1980:13-14) discusses a limnetic community (inhabiting an open lake or pond) that may have existed in the Big Lake region of the Eastern Lowlands of Arkansas. She notes that, "The flora was primarily various algae species. The fauna was essentially that of the marsh community (beaver, muskrat, river otter, mink), with a greater abundance of fish." Simonson (1947) notes that "A plethora of many varieties of fish existed. . ." in the lakes and streams of Mississippi County in the Eastern Lowlands.

Rivers and active streams would likewise have produced little vegetation. As Lewis (1974:25) notes, "Beyond fringe areas, . . . the plant component of this community is barely visible." Quoting Beckwith, Lewis (1974) lists buffalo (Ictiobus), catfish (Ictalurus), sunfishes (Family Centrarchidae), hickory snail (Dorosoma), and gar (Lepisosteus) as frequent catches in the southeast Missouri rivers and bayous. In the Western Lowlands streams and rivers, Harris (1981) notes the presence of long-nosed gar (Lepisosteus osseus), shore-nosed gar (Lepisosteus platostomus), big-mouth buffalo (Ictibus cyprinellus), yellow bullhead (Ictalurus natalis), channel catfish (Ictalurus punctatus), flathead catfish (Pylodictis olivaris), largemouth bass (Micropterus salmoides), freshwater drum (Aplodinotus grunniens), walleye (Stizostedion vitreum) and sauger (Stizostedion canadense) in addition to numerous minnows and other small fish.

Lewis (1974:26) defines a water millet-lily marsh community which is found, "on the lakeward sides of flood plain lakes, ponds and sloughs." This stagnant water habitat is dominated by water millet (Zizaniopsis milicea) and lily (Nelumbo lutea). Both of these plants are more or less restricted to the shallow edges of the ponds and lakes. Lewis notes, however, that water millet will flourish in areas too deep to permit the growth of cypress. In reference to community biomass, Lewis (1974:27) notes the following:

That water millet-lily marsh would have provided an abundant food supply for migratory waterfowl and the population of winter and summer waterfowl residents of the region as well as local aquatic mammal species.

It would seem that these aquatic habitats would have possessed a relatively high biomass for exploitation by human groups. It is difficult to ascertain the significance that differences between stagnant and flowing water communities may have had for exploitative strategies. Fish would certainly have been an abundant resource in both environments. Aquatic mammals would also have been available, although they were probably less important in this habitat and could have been more easily exploited in terrestrial areas that they tended to frequent. Waterfowl would probably have been more abundant in the backwater lakes and ponds than in free flowing water courses. Beyond variations in the species composition, this would seem to have been the major difference between the two aquatic environments.

Willow-Cottonwood-Sycamore Active Levee and Sand Bar Habitat

The terrain immediately adjacent to active streams and rivers may be termed transitory since it is being constantly altered by the processes of erosion and deposition. Shelford (1954:127) refers to this area of the flood plain as the "meander-belt" which is, "characterized by short annual submergence and molded by gradual shifting of the river from one side to the other." The biota associated with this landscape is likewise in a state of constant change, according to complex stages of plant succession. These stages within the meander belt here are governed responses to stages of land development and alteration. Newly formed land surfaces

within the meander belt, if not subsequently removed by erosion, will slowly build and mature. The associated biota will likewise change and mature. Once the land surface has stabilized and is no longer losing or receiving deposition, the occupying vegetation may reach some sort of climax situation. Braun (1975:295) has broadly defined the processes of succession in a flood plain situation.

The communities of river bottoms . . . developmentally related swamp and river-border communities . . . are, as deposition proceeds, replaced by mixed bottomland forest . . . of the hardwood or glade bottoms type. The stages in development differ from place to place, as indeed do the constituent species of the several communities . . . Excessive local deposition, resulting in the formation of natural levees and of the low crenulous ridges between bayous, permit the entrance of less hydric species . . . The frequent appearance of mesophytes in the best drained sites points toward the establishment of a mesophytic forest containing some of the species of the slope forest.

Shelford (1954) extensively discusses the stages of a plant sere within the Mississippi River meander belt which he calls "the short submergence terrestrial habitats and communities." Within this sere a number of time transgressive community stages are elaborated on. Lewis (1974) and Harris (1980) discuss similar communities; however, they deal primarily with the more mature communities and do not examine the earlier succession stages in detail.

Along the margins of rivers and streams, or within the meander belt, the development of new land surfaces occurs in the form of sand-bars, beaches and infant levees. These are initially made up of coarse grained sands which are frequently inundated in the early stages of land building. The primary pioneering woody plant to establish itself on this new terrain is Salix interior, the sand-bar willow. This plant will grow in tight clusters of samplings, which shade out most herbaceous plants. Black willow (Salix nigra) and cottonwood (Populus deltoides) may also be early constituents of the sand bar community; however, cottonwood is generally more common on more elevated, better drained soils (Shelford 1954:129; Lewis 1974:25). Hosner and Minckler (1963:36) note that, "Reproduction on newly-formed land areas consisted almost entirely of cottonwood and willow seedlings with a few boxelder, sycamore, silvermaple, and elm . . . The frequency of cottonwood and willow seedlings was significantly greater than any other species."

The tightly clustered sand-bar willows, once they are established, act as a constriction to water flow and thus enhance the normal rates of deposition. These deposits are usually a mixture of silts and sand, and, as they accumulate, they tend to elevate the primary land surface. The result is a habitat more conducive to cottonwood, which establishes itself on the highest, best drained areas (Shelford 1954). Black willow, a more water tolerant plant, will be found on the lower portions

of the new land surface, favoring the siltier, poorer drained soils. Given a chance, both Silix nigra and Populus deltoides will grow rapidly and eventually out-shade Salix interior (Shelford 1954:132; Hosner and Minckler 1963:38).

During the immature willow-cottonwood stage, herbaceous plants are for the most part eliminated, either by frequent inundation or by outshading. In late summer, however, after flooding has ceased, a few weeds will appear.

By late summer, because of the thick stand of trees and rather dense shade, there were only scattered herbaceous plants, usually the same species as those growing in the opening. Those growing in the shade supported only a few animals. . . This area was under only slightly less water in the spring of 1943 than the area of young willows (Shelford 1954:132).

Shelford's (1954) "mature cottonwood-willow association" is characterized by three factors: (1) short term and infrequent submergence, (2) thinning of dominant trees and (3) establishment of a relatively thick undergrowth. As this association approaches "old age," saplings of shade tolerant trees begins to form the understory. Harris (1981) and Lewis (1974) consider sycamore (Platanus occidentalis) to be a major constituent of this community, eventually coming to dominate the canopy. Braun (1975) also mentions a more diverse riverside community. In this physiographic climax, Lewis (1974:21) includes the following major trees in order of importance in his "cottonwood-sycamore" community: sycamore, cottonwood, elm (Ulmus sp.), ash (Fraxinus sp.), box elder (Acer negundo), mulberry (Morus rubra), hackberry (Celtis sp.), willow, black walnut (Juglans nigra), maple (Acer sp.), and Spanish oak (Quercus falcata). Undergrowth mentioned by Lewis (1974) included cane, spice bush (Lindera benzoin), pawpaw (Asimina triloba), trumpet creeper (Campsis radicans), red bud (Cercis canadensis), and black haw (Viburnum sp.). Shelford mentions grape (Vitis sp.), pepper vine (Ampelopsis arborea), poison ivy (Rhus radicans), blue vine (Ampelamus albidus), buck wheat vine (Brannichia cirhosa), morning glory (Ipomoea lacanosa), cockleburs (Zanthium pennsylvanicum), ironweed (Veronia) and thorny bramble (Rubus) as common members of the mature cottonwood-willow association herbaceous layer. These herbaceous layer plants,

together with other annuals, make a mass of vines covering tree trunks and binding and tangling them together so as to make passage very difficult except on old trails. In some open spaces where there has been disturbance, they cover the ground in a hip-deep tangle. . . . This growth tends to retard flood waters in the spring and thus increases deposition of silt" (Shelford 1954:133).

The annual composition for this more developed community includes white tailed deer (Odocoileus virginianus), black bear (Ursus americanus), mountain lion (Felis concolor), bobcat (Lynx rufus), raccoon (Procyon lotor), opossum (Didelphis virginiana), striped skunk (Mephitis mephitis), cottontail (Sylvilagus floridanus), red fox (Vulpes vulpes), gray fox (Urocyon cinereoargenteus), gray squirrel (Sciurus carolinensis), ruffed grouse (Bonasa umbellus), wild turkey (Meleagris gallopavo), and prairie chicken (Tympanuchus cupido) (Lewis 1974).

Non-active Levee Ridge Bottom Community

Continual shifting and cutting off by active rivers and streams often results in abandoned channels that eventually regress to backwater swamps and lakes and finally interfluvial flats. These abandoned channels are usually flanked by levee formations. Because of their removal from the immediate area of active water flow, the levee building process for all intents and purposes has ceased. These "interfluvial ridges" are rarely inundated and although some alteration may occur due to erosion, this is probably minimal due to the extensive plant cover usually found on them. The soils comprising these inactive levees are primarily coarse grained sands mixed with some finer silts.

The biotic community generally associated with this flood plain physiographic feature is called the "Ridge Bottoms forest" by Braun (1975:295), the sweetgum-elm "Cane Ridge forest" by Lewis (1974:21), the "Mixed-Hardwood forest" by Hosner and Minckler (1963:31), the "Sweetgum-Elm-Hackberry association" by Harris (1980:10-13), and the "Hackberry-Sweetgum community" by Shelford (1954:134). Harris mentions an even more mesic community, the "white oak-sweetgum" plant association, which is similar to the sweetgum-elm-hackberry association but apparently is found on extremely dry terrain that is very rarely, if ever, inundated (Harris 1980:12-13).

Major plant constituents of this community include elm (Ulmus sp.), ash (Fraxinus), hackberry (Celtis occidentalis), sweetgum (Liquidambar styraciflua), hickory (Carya sp.), black oak (Quercus velutina), maple (Acer sp.), box elder (Acer negundo), hornbeam (Ostrya virginiana), black walnut (Juglans nigra), and burr oak (Quercus macrocarpa) (Lewis 1974:21; Harris 1980:10-13). In addition to these trees, numerous more hydrospheric species are present in low frequencies and probably are more common on the lower, less well drained portions of these ridges or levees.

Undergrowth in the inactive levee ridge bottoms community is relatively heavy. Braun (1975:295) and Lewis (1974:22) note the numerous occurrences of cane on these well drained ridges. "This plant was recorded with such great frequency in GLO records that is undoubtedly constituted the most common undergrowth" (Lewis 1974:22). Interestingly, as Harris (1980:3-13) notes, little cane was noted in the Buffalo Creek Project area by General Land Office (GLO) surveyors. It may be that extensive "cane breaks" are local secondary growth phenomena associated with

disturbed areas. Other herbaceous layer plants include pawpaw (Asimina sp.) spice bush (Lindera benzoin), black haw (Viburnum rufidulum), red bud (Cercis canadensis), green brier (Smilax sp.), grape vine (Vitis sp.), trumpet vine (Campsis radicans), poison ivy (Rhus radicans), and virginia creeper (Parthenocissus quinquefolia) (Lewis 1974:22-23).

Harris (1980) suggests that fauna would have been extremely numerous in this community compared to other flood plain communities. Bear (Ursus americanus), white tailed deer (Odocoileus virginianus), opossum (Didelphis virginiana), cottontail (Sylvilagus floridanus), grey squirrel (Sciurus carolinensis), eastern fox squirrel (Sciurus niger), elk (Cervus canadensis), mountain lion (Felis concolor), raccoon (Procyon lotor), bobcat (Lynx rufus), wolf (Canis lupus), red fox (Vulpes vulpes), striped skunk (Mephitis mephitis), and other small mammals would have been present (Lewis 1974; Harris 1980). Major birds frequenting this habitat were prairie chicken (Tympanuchus pallidicinctus), ruffed grouse (Bonasa umbellus), pigeon (Columba sp.), and wild turkey (Meleagris gallopavo) (Lewis 1974:23). Shelford (1954) includes a number of reptiles and amphibians in a "hackberry-sweetgum forest community: that is similar to this community. During periods of flooding these elevated ridges would have provided refuges for many of the non-aquatic animals inhabiting the flood plain.

Harris (1980) has suggested that the great plant and animal diversity apparent in this community is in part due to the short term annual inundation of at least part, if not all of this habitat. The tree species composition indicates a mixing of hydrophytic and flood-tolerant, more mesophytic plants. As Braun (1975:295) notes, "the formation of natural levees and of the low ceronuous ridges between bayous, permits the entrance of less hydric species." Lewis (1974) suggests that this community reporesents an adaphic climax which is the result of "micro-climatic, topographic, and pedological variables." Within the flood plain sere then it would seem that this community is the end product of a general hydrarch succession. Succession to a truly mesophytic oak-hickory forest would probably not be possible in the Mississippi flood plain, except in a few, isolated, very well drained areas. Harris (1980) refers to a "white oak-sweetgum association" which is very limited in extent in the well drained Big Lake highlands in the Eastern Lowlands of Arkansas. Most areas are occasionally inundated which would tend to exclude many species of such an association. In the long run, the succession to a more mesophytic forest on the ridges and levees may be viewed as temporary. While inundation of these habitats may be rare, the surrounding terrain is frequently flooded, resulting in an annual deposition of clays and silts. The long term effects of this process is the gradual raising of the poorly-drained landscape as flood plain prominences are reduced in height by erosion. Therefore, these once elevated, well drained areas eventually merge with the surrounding landscape. The expected vegetational response to such processes would be a return to dominance by more hydrophytic species.

Backwater swamps, sloughs and lakes were once extremely common and extensive physiographic features in the flood plain region of northeastern Arkansas. Hosner and Minckler (1963:39) note that the alluvium deposited in these areas is primarily composed of fine-textured grains of clays and silts. These deposits generally tend to enchain the poorly drained quality of these areas. Furthermore, as Braun notes (1975:290) levee formation along active streams tends to inhibit lateral drainage of interfluvial areas. Two broad categories of land surfaces in these poorly drained interfluvial areas can be defined. One consists of low lying swamps, sloughs, and lakes which retain standing water for most, if not all, of the year. The other category of poorly drained lands are often referred to as "flats." These are lands which were once characteristic of the previous category but were slowly elevated by the gradual deposition of clays and silts. Although the soils characteristic of these flats are poorly drained, inundation is not quite as prolonged as in the lower areas (Hosner and Minckler 1963:39).

Cypress-Tupelo Swamps and Sloughs

Lewis (1974:25) discusses a biotic community called the "cypress deep swamp" which is essentially equivalent to Harris' (1980:10-13) cypress-tupelo plant association and Hosner and Minckler's (1963:39) poorly drained swamps and slough communities. Shelford's (1954:140) "aquatic sere cypress swamp stage" is also roughly equivalent to the above mentioned biotic groupings.

Lewis (1974:26) does not include tupelo (*Nyssa aquatic*) in his deep swamp community because the Government Land Office survey notes for the townships and ranges with which he was concerned did not record it in their observations. He notes that, "The absence of this species is surprising as it is a common associate of bald cypress throughout the Lower Mississippi Valley. It is historically known from the region and is present in adjoining localities." In northeastern Arkansas, the GLO surveys of Township 15, Range 6, 7 and 8 noted that of 1081 witness trees 5 percent were tupelo trees and 9 percent were cypress. A cross-tabulation of witness trees by Harris (1981) produced a definite correlation between tupelo and cypress. The cypress-tupelo association appears then to have been a valid community in the poorly drained swamps and sloughs of northeastern Arkansas.

Hall and Smith (1955) note that cypress and tupelo both are highly tolerant of long term submergence. These trees are therefore able to thrive in areas where standing water is a semi-permanent characteristic. Shelford (1954) notes, however, that occasional elimination of standing water is essential to the reproduction of cypress. "It is evident . . . that two or more years of drought are essential for germination and establishment". Demaree (1932:140) found that seeds must sprout when not submerged and the seedling must not be submerged". This, therefore, restricts the community to areas which are relatively shallow and subject to occasional drying.

In addition to cypress (Taxodium distichum) and tupelo (Nyssa aquatica) Lewis (1974:26) notes that the undergrowth, although sparse, may include cattails (Typha latifolia), queer vine (Brunnichia cirrhosa), hibiscus (Hibiscus lasiocarpus and H. militaris), and buttonbush (Cephalanthus occidentalis). In reference to the fauna of this community, Lewis (1974:26) states that, "The larger mammalian species, such as deer, bear, mountain lion, and elk would probably have penetrated only to the fringes of the cypress community in areas which were relatively dry or having very shallow water". Other animals such as rabbit (Sylvilagus sp.), muskrat (Ondatra zibethicus), mink (Mustela vison), and otter (Lutra canadensis) would have been present and possibly abundant. All of the above mammals were recovered from archaeological context at the Zebree site in various frequencies (Guilday and Parmalee 1977:258). Their presence in the northeast Arkansas lowlands is thus well documented. Birds listed by Lewis (1974) included "species of ducks and other waterfowl seasonally".

Harris (1980:13-14) summarizes the cypress-tupelo community as follows:

The cypress-tupelo biotic community was inundated for a longer portion of the year. Few other floral species were of importance; the primary faunal species were fishes and fish eating birds, and some aquatic mammals. This community may have included marshes and other areas of standing water.

Mixed-Hardwood Interfluvial Flats Forest Community

Periodic deposition of clays and silts and the constant accumulation of falling organic debris in sloughs and swamps results in the gradual conversion of these areas into seasonally inundated terrestrial habitats. These areas are poorly drained, and during the wet season standing water is usually present. The floral composition of this landscape is a mixture of bottomland hardwoods, all of which are relatively tolerant of seasonal inundation (Harris 1980; Lewis 1974; Shelford 1954; Hosner and Minckler 1963; Hall and Smith 1955). Equivalents of the Mixed-Hardwood Flat Interfluvial Forest are Harris' (1980) cypress-hardwood association, Lewis (1974) sweetgum-elm-cypress seasonal swamps, Hosner and Minckler's (1963) poorly drained mixed soft hardwood forest, and Shelford's (1954) sweetgum dominated long submergence habitat community.

Major trees in this community include sweetgum (Liquidambar styraciflua), elm (Ulmus sp.), ash (Fraxinus sp.), oaks (Quercus sp.), hackberry (Celtis sp.) and cypress (Taxodium distichum) (Shelford 1954:139; Lewis 1974:24; Harris 1981:10-13; Braun 1975:292-293). Lewis suggests that this community represents a late stage in a physiographic sere. He quotes Putnam and Bull (1932:181) who state, "It is probable that these sites were originally lower and formerly occupied almost entirely by cypress, which is now being gradually replaced by red gum (i.e., sweetgum) (which started in an understory) as the sites are built by deposition of silt and clay" (Lewis 1974:24). Harris (1981) and Shelford (1954) also consider this community to be transitory, originating in the cypress-tupelo

community. Further improvement of the drainage in the interfluvial flats through continued deposition may allow more mesic species to flourish in this community (Hsoner and Minckler 1963:39).

In general, the herbaceous layer plants are lacking. Lewis (1974:24) suggests that this is probably due to frequent prolonged inundation followed by periods of no water. In northeastern Arkansas, some undergrowth must have been present as section line undergrowth summaries commonly refer to the presence of "bushes, vines and brier." Unfortunately, the notes are rarely more specific. Occasional references do note that the undergrowth, besides being comprised of green briars and rushes, is of saplings similar in composition to the canopy trees (Owen 1848).

Lewis (1974:24) lists the following animals as common frequenters of the interfluvial flats community during dry seasons: deer (Odocoileus virginianus), cottontail rabbit (Sylvilagus floridanus), swamp rabbit (Sylvilagus aquaticus), bear (Ursus americanus), beaver (Castor canadensis), muskrat (Ondatra zibethicus), and woodrat. Birds would also have been present, including wild turkey (Meleagris gallopavo), ruffed grouse (Bonasa umbellus), prairie chicken (Tympanuchus cupido), and pigeon (Columba sp.) as the most common types.

Climate

The average annual temperatures in northeast Arkansas range from about 41 degrees to 80 degrees F. In winter the mean daily minimum temperature is 32 degrees; in summer it is 91 degrees. The first freeze of the year with minimal killing potential normally occurs in late October, while the last killing frost usually occurs no later than the first week in April. As a result there is a growing season of approximately 220 days.

Precipitation totals average about 48 inches per year. Of this total, 50 percent falls in April through September. Snowfall occurs in the area, with a mean total of seven inches per year. The snow, however, does not last usually more than a day or two from any single storm.

Before construction of the vast artificial levee networks characteristic of the valley, flooding was a frequent occurrence. Unfortunately, when these levees are breached today, the resulting flood is frequently of a greater severity than was formerly the case. Before extensive flood control, inundation of low-lying areas occurred annually and predictably during the spring rise of the Mississippi River and its tributaries. Both settlement and subsistence patterns could make use of predictable flood episodes. Such floods were a major factor in recharging swamplands. Today, with most of these lands drained and occupied, flooding of even a minor nature creates problems unforeseen prior to artificial levee construction.

Present Land Use

Most of northeastern Arkansas today is agricultural. Approximately 90 percent of the total acreage in Mississippi County is agricultural. The remainder of county land consists principally of a few low lying wooded tracts, towns, and transportation facilities. Crops in this area are mostly soybeans, cotton, wheat, and alfalfa. While not yet a widely grown crop in Mississippi County, rice is increasing in importance in the Eastern Lowlands.

Northeastern Arkansas at the Turn of the century was heavily forested. A few of the more prominent species (discussed in detail above) included sweetgum, cottonwood, hackberry, baldcypress, sycamore, and numerous varieties of oaks. Land clearing by the mid-1960s had reduced this forest cover to less than 10 percent of the total land area in Mississippi County alone. Stands of woods today are limited to second and third generation species located along the inner side of levees and planted windbreaks. This tremendous amount of clearing was brought about first by lumbering interests. This was then followed by increased agricultural interests from about 1920 to the present.

Sites 3MS351, 3MS346, and 3CG487 in the project area have been intensively cultivated since the 1920s. Because of its low lying nature, site 3MS351 was probably the last to be cleared. Today, soybeans and cotton are the crops mainly grown on the sites. In previous years corn was grown, and at least for site 3MS351, English peas and lima beans.

All the sites also showed evidence for the former wooded environment. Archaeological imprints of felled trees were found as well as apparent stumps. Numerous stumps apparently rotted in the ground, leaving well defined stains, because before the 1920s they could not easily be removed except by mule team and winch. Harrison (1954:367) notes that in many cases, even today, stumps are simply left to rot because of the large holes created when removing them by heavy machinery.

Land leveling appears not to have been a significant factor at the three sites. In other areas of northeastern Arkansas this practice has destroyed hundreds of sites. Erosive forces, however, have contributed to site destruction. Since clearing and cultivation, wind erosion on sites 3MS346 and 3CG847 has been particularly harsh. Both sites are located on fine dune sands which are subject to shifting. At least one intensive sand storm was encountered in the field. Medford (1972:69) points out that in the dune areas of the Western Lowlands archaeological materials are frequently found out of context because of the erosive nature of the wind on the dune sands. This was borne out on sites 3MS346 and 3CG847. Site 3MS351 was subjected to more direct fluvial erosive forces than aeolian forces, although both forces acted on all three sites to some degree. Local site geomorphology will be discussed for each site in this report.

Summary

It is quite apparent from the previous discussion that the biotic environment of northeastern Arkansas was, up until the recent historic period, extremely diverse and very dynamic. As one moves from east to west a number of major, ecologically distinct, biotic regions are encountered beginning with the Loess Hills, in which the heavily dissected upland terrain supports a Western Mesophytic Forest type and its association of abundant fauna. This region borders the Lower Mississippi Valley, which because of its very dynamic landscape, supports an extremely complicated, delicately balanced and very diverse range of smaller biotic environments that are constantly changing their position in response to changes in the landscape. Subdivisions readily apparent within the northeast Arkansas Lowlands of the Mississippi Valley include active and non-active aquatic habitats where a wide variety of waterfowl, aquatic fauna, and marsh and river edge flora are frequently found. Dynamic landscape adjacent to active streams, which would include levees and sandbars, likewise possess uniquely dynamic flora and faunal communities. In the low areas between these more active channels a mature and somewhat less dynamic biotic environment, dominated by bottomland hardwoods, may be encountered. In the rich undergrowth of these interfluvial areas live abundant semi-aquatic and terrestrial fauna. Older levees, offering well drained and infrequently inundated terrain, would provide a unique habitat for more mesic inclined plant and animal life within the very hydrophytic oriented environment of the lowlands. The diversity in the terrain and soils of the Arkansas Lowlands is thus reflected in the very diverse floral and faunal compositions that inhabit this region.

The rich diversity of the lowlands environment is interrupted by Crowley's Ridge, an upland remnant that supports a very different kind of biota that in many respects is identical to the flora and fauna of the Loess Hills to the east. This narrow, elevated ridge of land stands in marked contrast to the surrounding lowlands, in terms of both its geology and its plant and animal life. The contrast between these two areas adds further to the impression that northeastern Arkansas is characterized by a very diverse ecology.

The western edge of the Mississippi Valley is formed by the abrupt escarpment of the Ozark Plateau to the north and the Ouachita Mountains to the south. Here again is an area that is unique in its biotic constituents. Considerable variation in elevation and other aspects of the terrain are correlated with similar variation in plant and animal life.

In summary, it is clear that northeastern Arkansas is ecologically diversified. The probability that this diversity extended far into the past is high since the factors that account for it are generally not conducive to rapid change. While the actual composition of the biota may have varied substantially through time, a persistence in the presently observable diversity of the ecology within this region would be expected. This pattern would undoubtedly have substantially influenced the behavior of the human groups that have occupied this region over the past 10,000 years.

CHAPTER 6

THE LATE PLEISTOCENE-EARLY HOLOCENE ENVIRONMENT OF NORTHEASTERN ARKANSAS

Introduction

Recent evidence collected by the Buffalo Creek Archaeological Project in the field and from written sources suggests that the environment of the north-eastern Arkansas Lowlands during the Early Holocene Period may have been very different from what traditional interpretations envision. It is during this period, from approximately 10,000 to 7000 years B.P., that the human occupation of the region becomes substantially apparent.

Our reassessment of the situation in northeastern Arkansas was stimulated by the recovery of a pollen sample from the Steele site that suggested that isolated stands of northern boreal forest species may have persisted in the Lower Mississippi Valley for several thousand years longer than is generally accepted. Subsequent research in comparative fields has provided some paleo-climatic, geomorphological, and paleo-faunal evidence that supports this hypothesis. The following discussion is an attempt to synthesize these data and suggest what implications they might have for the existing perspective on the paleo-environmental and cultural history of the region.

The patterns of Late Pleistocene-Early Holocene climate and associated biota in the northern section of the Lower Mississippi Alluvial Valley may have been somewhat unique, when considered in light of continental scale patterns. In all respects, it can be characterized as exceedingly dynamic. The broad paleo-environmental phenomena documented for the North American continent has variable implications for regional climates and biota, and does not necessarily typify the prevailing circumstances in northeastern Arkansas during this time.

Climatic Evidence

The traditional concept of the climatic transition from the Pleistocene to the Holocene describes a period of gradual continent-wide increases in temperatures (Bryson, Baerreis and Wendland 1970:55). This climatic trend commenced approximately 17,000 years ago, reaching a peak about 7,000 years ago. After this temperatures gradually declined, with minor fluctuations (Davis 1976:18; Wright 1976:581; King 1980:4). The major impact of increased temperatures on the configuration of the North American landscape was the subsequent reduction of the Laurentide ice sheet. This event, which ceased approximately 5,000 years ago, had considerable impact on the composition and nature of the Late Pleistocene and Early Holocene biotic and abiotic environments of northeastern Arkansas. Before discussing the regional-specific climatic phenomena, however, it will be necessary to examine in further detail the major aspects of the continental climatic patterning.

As previously noted, the climatic trend during the Pleistocene-Holocene transition was one of gradually warming temperatures. Bryson and Wendland (1967:271-298), Bryson, Baerreis and Wendland (1970:53-74), and Webb and Bryson (1972:70-115) have conducted extensive studies of the climatic patterns during this time and have mapped these patterns for the North American continent. Most of this information is based on dated pollen studies because of the correlations between vegetation zones and climate.

During the Late Wisconsin (ca. 13,000-10,500 B.P.) mean annual temperatures for the North American continent were several degrees colder than at present. The southward edge of this cold Arctic frontal zone extended well into the middle latitudes of the continental interior (ca. 35°). In the southeastern United States, tropical air from the Gulf of Mexico reached the 40° latitude in warm seasons and retreated to the 35° parallel during winter. Westerly air flows from the northwest Pacific were not particularly prevalent at this time, although they did form a narrow wedge of air extending into the central Plains region (Bryson and Wendland 1967:281-287; Bryson, Baerreis and Wendland 1970:58).

The Laurentide ice sheet at this time was aligned primarily along the 45° parallel. The estimated maximum thickness of this glacial ice gave it an elevation of at least 3,500 meters above the surrounding landscape. As Bryson and Wendland note (1967:284) this was of sufficient height to effectively block the flow of extremely cold arctic air masses directly into the unglaciated North American interior. They characterized the flow of northern air during this time as much warmer than traditionally envisioned.

With all cold air masses shallower than this depth (3,500 meters) blocked from entering southern North America, it is clear that the flow from the north into the midwestern United States would have been Katabatic, with adiabatic heating on the order of 30°-35° Centigrade. Any reasonable assumption of representative temperatures on the ice-cap averaging higher than -60° Centigrade would mean air entering the United States no colder than at present and usually warmer Adiabatic warming of air from the west would be as great as at present, and air from the south would be about as warm as the present (Bryson and Wendland 1967:284:286).

While these general climatic conditions had important implications for the structuring of regional climates, they did not necessarily characterize the climatic events during the Pleistocene-Holocene transitional period on a local scale such as in northeastern Arkansas. Very little data exist for this specific area. In contrast, however, a comparatively large amount of literature exists concerning the paleo-climatology of the central Great Plains and Prairie Peninsula Provinces of North America. Some researchers have tended to extrapolate these data into climatological descriptions of other regions without taking into consideration the specific variables of those areas that may have affected climatic phenomena. The problems with this sort of approach have already been pointed out. Correlations between climatic patterns in different regions may vary considerably due to regional morphology.

The above situation is certainly not a traditional interpretation of the Late Pleistocene-Early Holocene climatic conditions in northeastern Arkansas. However, the mechanics of such a climatic situation are well documented (Critchfield 1966:57-58), and if all of the assumed variables were present as they appear to have been, then it is distinctly probable that these conditions did exist in northeastern Arkansas. The moisture content (humidity) of the tropical air masses which prevail in the southeastern United States during the warm season is infamous in that region. As Critchfield notes (1966:66), "Warm ocean currents offshore increase the moisture content of winds which blow across them". According to Bryson and Wendland (1967) this same pattern of air flow existed during the Late Pleistocene although the maximum latitudinal extent of the tropic air front has shifted somewhat northward to its present position. Therefore, available humidity would have been sufficient to maintain advection fogs in this region at least during the summer months. Exactly for how long this particular climatic situation may have persisted in northeastern Arkansas is a critical question requiring further discussion. It is proposed, however, that this situation could have prevailed well into the Early Holocene.

Floral Evidence

Delcourt and Delcourt (1975) have utilized the present distribution of climatically diagnostic "index plant species" to support their hypothesis of Lower Mississippi Valley Pleistocene age climate. Unfortunately, no estimate of temporal duration is available for this proposed condition. Furthermore, fossil pollen or paleo-macrobotanical studies for northeastern Arkansas that could be correlated with this climatic situation are unfortunately absent. A study by King and Allen (1977) of an area fifty miles north of the Buffalo Creek Project area provides substantial data on local vegetation but does not extend earlier than 8810±90 years B.P. (King and Allen 1977:314). A pollen sample extracted from braided stream deposits adjacent to site 3MS351 during the Buffalo Creek Diversion Project may be significant with respect to determining the characteristic of local paleo-environmental conditions. An extensive discussion by Bozarth of this pollen study is presented as an appendix to this report; however, references to it will be made here as it pertains to this discussion.

As mentioned above, the pollen sample was extracted from a soil stratum deposited by a braided stream channel. For reasons discussed elsewhere in this report, it is strongly felt that the pollen in this stratum was not transported but is representative of local floral conditions. Table 6-1 illustrates the frequency counts and percentages of individual plant species represented in the pollen sample.

Table 6-1. Frequency Counts and Percentages of Plant Species

Plant genus	number of pollen grains	Relative %
Picea (spruce)	121	42.6%
Pinus (pine)	42	14.8
Corylus (hazel)	32	11.3
Salix (willow)	11	3.9
Betula (birch)	6	2.1
Populus	3	1.1
Quercus (oak)	17	6.0
Celtis (hackberry)	16	5.6
Ostrya (hop-hornbeam)	6	2.1
Carpinus (hornbeam)		
Fraxinus (ash)	5	1.8
<u>Acer</u> (maple)	1	.3
Urticaceae (nettle)	4	1.4
Poaceae (grass)	5	1.8
unidentified	<u>15</u>	<u>5.2</u>
Total	284	100.0

The high values observed for the conifers (*Picea* and *Pinus*) are indicative of certain climatic characteristics. Extremely warm temperatures, such as occur in northeastern Arkansas today, are not conducive to the growth of *Picea* seedlings; this indicates that cool summers were probably a component of the local climate (Wright 1976). Butzer (1971:71) notes that, "The peculiar adaptation of conifers to the subhumid, subarctic lands is generally thought to be related to two factors". One of these is the configuration of their needles, which have a reduced surface exposure over deciduous leaves and are therefore not as susceptible to water loss by transpiration. This is apparently a response to harsh winters, "a time of severe drought stress as the result of persistent dry and cold winds" (Butzer 1971:71). The second factor is the possession of permanent leaves characteristic of conifers. In areas where there are low temperatures and reduced or limited amount of sunlight permanent leaves are capable of immediate photosynthesis whenever conditions are favorable. These environmental criteria suggest that when these conifers were present in northeastern Arkansas the climate was characterized by harsh winters and cool summers, accompanied by limited sunlight.

A radiocarbon sample was obtained from bone extracted from deposits identical to the braided stream deposits from which the pollen sample was taken. The sample was processed by Beta Analytic Inc., and a date of 7050 ± 120 B.P. (Beta-4383) was obtained. Using the new half life value of 5730 ± 40 years the corrected value of this date is 7254 ± 120 B. P.

This date indicates that spruce dominated floral associations were present in the Lower Mississippi Valley much later than has been traditionally thought. However, the northward shift of boreal forest at the end of the Pleistocene was probably not altogether uniform. Sporadic stands of boreal forest could have persisted in parts of the southern United States if local conditions were conducive in their survival. Larson, Bryant and Patty (1972) have recovered *Picea* pollen from a bog in Texas which could date as recent as 10,000 years ago. The site of this pollen study is approximately 500 miles south of the Buffalo Creek Archaeological Project area. Isolated stands of spruce occur in the Kaibab Plateau region of Arizona which is located along the same latitude as northeastern Arkansas. The specific local climatic and edaphic conditions of this region, which are primarily a function of elevation, allow boreal species to thrive far south of the present range of extensive boreal forest (Merkle 1954). As Bryson et al. (1970:72) note;

We have implied that significant climatic changes are those which produce regional ecological changes of more than subtle character, but we must reiterate that the direction of the change will not be the same everywhere and that there must be many climatic/ecotic core areas with very little change.

If the local environmental conditions for northeastern Arkansas during the Late Pleistocene and Early Holocene period did exist then it is quite probable that this date is correct and spruce dominated forest communities were present in this area well into the Holocene. The extent of these stands cannot be determined on the basis of a single sample, and it may well be that this represents an isolated occurrence.

The presence of deciduous-thermophilous tree species in boreal dominated pollen sample is not unusual for Late Pleistocene-Early Holocene samples in North America. In fact it tends to be very common for low percentages of deciduous species to be present (Wright 1970). The continual reoccurrence of this combination of pollen types argues against some form of contamination. It would appear, as Wright (1970) has concluded, that sporadic occurrences of deciduous-thermophilous species was a normal constituent of the Late Pleistocene-Early Holocene boreal forest. It is also possible that these combinations represent a transition or succession from pure boreal to deciduous in response to changing environmental conditions. A continuous column sample of pollen representing a long period of time is unfortunately not available from the Steele site data due to poor preservation. Conclusions based on a single, isolated sample must remain highly tentative pending the recovery of additional paleoenvironmental data.

Faunal Evidence

Morse (1969, 1981), Goodyear (1974), and Klinger and Math's (1978) have noted the numerous finds of extinct Pleistocene fauna in the northeast Arkansas region. Species of mastodon (Mammot), giant beaver (Castoroides), horse (Equus), tapir (Tapirus), and ground sloth (Megalonyx) and possibly elk (Cervus) have been recovered from various contexts in the lowlands of Arkansas (Goodyear 1974:13; Morse 1969:45). The implications that the presence of these various species have for regional environmental reconstruction are unclear, and it is doubtful that any specific statements can be formulated beyond general speculation. Lundelius (1967:297) has noted the problems associated with using extinct and extant fauna in defining paleoenvironmental conditions. Primarily fauna are much more flexible in terms of habitat preference than plants and are therefore not good environmental indicators. Additionally, precise dates are lacking for all of these faunal sites.

Martin and Guilday (1967:42) note that Tapirus may have been exclusively associated with humid climates, although specimens of Tapirus recovered from non-humid areas may cast doubt on this assumption. It is known that Tapirus, which was previously thought to have become extinct at the end of the Pleistocene, continued to live in North America into the Holocene (Martin 1967:80).

The genus Equus appears to have inhabited a variety of environments. Unfortunately, species identification of the Arkansas specimen is not available. Megalonyx may have preferred a temperate, woodland environment and appears to have survived into the early Holocene (Martin and Guilday 1967:132). Elk, according to Guilday (1967), preferred lowland habitats adjacent to swamps.

Mastodons may have survived in some areas well into the mid-Holocene. Griffin (1965:658) suggests that these animals survived in some areas until 4000 years ago. The Island Number 35 mastodon found in the Mississippi River adjacent to Arkansas may have been associated with lithic tools possibly diagnostic of the Early Archaic cultural period (Williams 1957). The association of these artifacts with the mastodon, however, was unclear and it may be the result of posthumous processes (Morse 1969:48). Martin and Guilday (1967:36-37) provide the following description of the supposed habitat of mastodons.

From associated pollen it is certain the American mastodon occupied late-glacial boreal forest or woodland, characterized by spruce and other coniferous trees. However, mastodon are known as far south as central Florida in Pleistocene deposits far beyond the southern limit of boreal forest even during the time of its maximum Wisconsin age displacement. Mastodons were certainly not confined to coniferous forest habitats.

Lundelius (1967:297) suggests that mastodons were restricted primarily to stream valleys. He suggests that they were particularly numerous in the Gulf Coastal Plain province. The extinction of these animals is believed by Guilday (1967) to have been the result of a progressively closing canopy and increased competition.

In a situation of progressively closing forest canopy, primary grazing types would be most affected. The fossil record seems to bear this out. I suggest that the mastodon could not survive in a closed-canopy forest in close competition with more efficient browsers and was not confined to, but flourished best in the same habitat as that of the equally defunct giant beaver--extensive lake margins and swamps, the habitat occupied today by the moose (Guilday 1967:132).

In an article by Morse (1969) he discusses six individual mastodon sites in the Eastern Lowlands of Arkansas. One of these, the "Swihart" Mastodon was encountered approximately 2.25 miles (3.6 km) due north of the Steele site during the excavation of a drainage ditch. Unfortunately, no specific stratigraphic information was provided; however, an inspection of the soil survey maps for Mississippi County (Ferguson et. al. 1971) indicate that the location of the mastodon find is in the center of a relict braided channel scar. Furthermore, this is the same relict scar that is adjacent to the Steele site (Fig. 6-1), the deposits of which were dated by radiocarbon to 7050±120 years B.P. If the Swihart Mastodon remains were associated with these braided stream deposits then there is a strong suggestion that this animal survived in northeast Arkansas well into the Holocene.

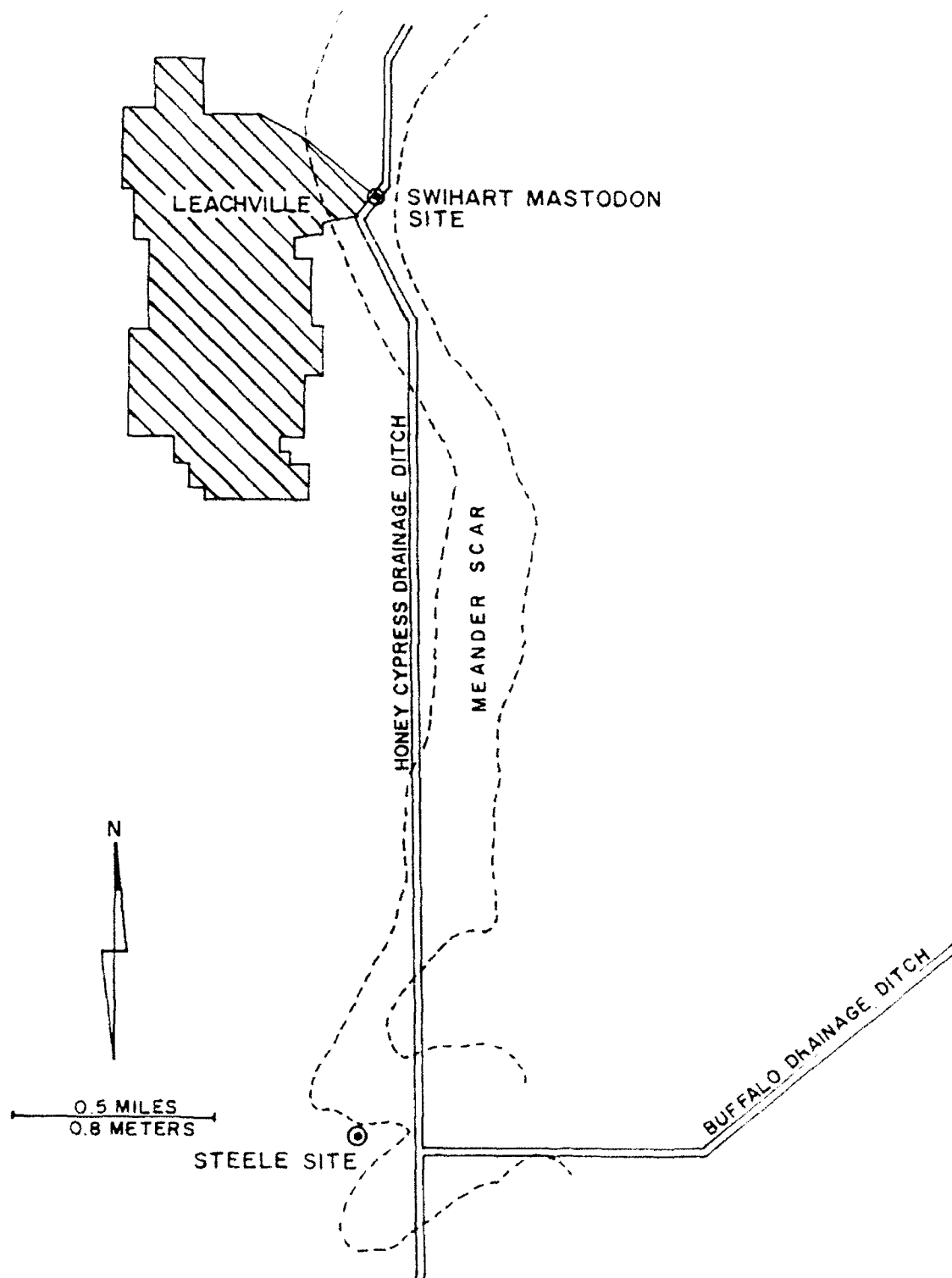


Figure 6-1. Swihart Mastodon site and its relationship to the braided stream meander scar adjacent to the Steele site (3MS351).

Guilday (1967:132) notes that the habitat of mastodons and the giant beaver, Castoroides, appear to overlap. Schultz (1967:324:425) suggests that these animals were associated with "medium sized perennial streams" in a climate characterized by cool summers. In Kansas, Castoroides has been found in association with a mixture of coniferous and deciduous-thermophilous tree pollen (Schultz 1967).

A large amount of animal bone was recovered during the excavations at the Steele site from a matrix of braided stream deposits. As has been previously noted, this material yielded a radiocarbon date of 7050±120 B.P. The species of animals associated with this deposit are apparently not good environmental indicators; however, the date produced by these remains is important because it indicates that the braided stream system was active at this late date. A list of the fauna recovered from this context is provided by Table 6-2.

Summary

Evidence suggests that the environment of northeastern Arkansas may have maintained many characteristics of the Late Pleistocene environment well into the Holocene. The specialized climatic conditions produced by the glacial melt-water and movement of major air fronts may have produced an environment conducive to the persistence of boreal forest species in northeastern Arkansas after these plants had disappeared in other regions. There is also the suggestion that this unique floral association was accompanied by the persistence of certain Pleistocene megafauna, particularly the mastodon, whose remains have been encountered at numerous locations in the Arkansas lowlands.

If the 7050 B.P. radiocarbon date is correct for the faunal material recovered adjacent to the Steele site (3MS351), then the environment continued to be dominated by an active braided stream system at least until that time. The dynamic nature of this type of hydrology would have been a decisive agent in structuring the landscape of the Eastern Lowlands region and would have directly affected the composition and types of flora and fauna. Additionally, this environment would have presented a unique range of variables to prehistoric groups occupying this region.

TABLE 6-2.

Feature 5 Faunal Remains from Braided Stream Deposits

Specimen	Weight of Bone (grams)
<u>Chrysemys</u> sp. (pond turtle)	3.0
<u>Sternotherus odoratus</u> (stinkpot turtle)	6.0
<u>Ictalurus punctatus</u> (catfish)	99.0
<u>Esox</u> sp. (pickeral)	2.0
<u>Amia calva</u> (bowfin)	1.0
<u>Rana</u> sp. (frog)	1.0
Unidentifiable fish bone	3.0
<u>Didelphis virginianus</u> (opossum)	4.0

CHAPTER 7

LITHIC RAW MATERIAL RESOURCES DESCRIPTIONS

Introduction

It is apparent from the wealth of lithic artifacts recovered during the Buffalo Creek Project and from similar projects in northeastern Arkansas that stone was an extremely important raw material to the prehistoric populations of this region. This emphasis or reliance on stone becomes even more apparent when it is realized that no naturally occurring lithic materials are present anywhere in the Arkansas lowlands that would have been accessible to aboriginal groups, given their specific level of technology.

All lithic artifacts found in the lowlands region were manufactured of stone that had to be transported from resources outside of the area. The nearest source of lithic raw materials to the Buffalo Creek project area is approximately 25 miles to the west, and it is apparent from the analysis of the lithic artifacts that much of the material came from much greater distances. Because of research questions discussed in Volume II of this report, a comprehensive description of lithic resources and their locations was performed. Most of these resources are found in portions of the state of Arkansas; however, a few varieties that are known to have been widely traded during the prehistoric period are included.

Lafayette Chert

The closest, most readily available lithic resources to prehistoric inhabitants of the northeast Arkansas Eastern Lowlands were the Lafayette gravels. This extensive deposit of residual chert material is located on Crowley's Ridge overlying sandstone basal deposits formed during the Tertiary geological period. These gravels apparently originated in the Ozark region and were eroded out and redeposited during the Pleistocene period. Their importance to aboriginal groups in the Arkansas lowlands has been extensively discussed and documented (Manger n.d. 207-209; House 1977:11-12; Morse 1969:15; Morse and Million 1980:15-26; House 1975:81-84; and Padgett and Ray 1977:87).

Since the Lafayette gravels were derived from eroded portions of the Ozarks, it is often difficult or impossible to distinguish these gravels from parent Ozark-obtained materials when they are encountered out of geological context. At the Zebree site in the eastern Arkansas lowlands Morse and Million (1980:15-27) noted that, "Since much of the water-worn lithics found on Crowley's Ridge originated from Ozark strata and since a significant amount of Ozark chert cobbles were gathered from secondary gravel deposits, it will always be difficult, if not impossible, to differentiate with any degree of certainty, between Ozark and Crowley's Ridge cherts".

House (1975) has extensively collected and described Lafayette gravels. He notes that the material on which he based his study, however, does not represent a sample of the range of variation in quality and kind of chert gravels present on Crowley's Ridge. During his collection, selection of individual cobbles was made with the intention of using the material for

knapping and fire-cracked rock experiments. "Thus it was not representative of the Ridge gravels as a whole but included much more solid grained, even textured cobbles than are typical of the deposits" (House 1975:82). These are probably the same properties, however, that prehistoric groups would have selected for in procuring Lafayette chert. It would therefore seem that for the purposes of recognizing this material at archaeological sites in the lowlands, House's study is more than adequate. Based on this sample he provides the following description,

The cortex of a majority of the cobbles is brown, reddish brown or greyish brown and, though smoothness is variable, is generally quite smooth. The interior of the chert is quite variable in color; brown, tan, greyish tan, yellowish tan, and cream-colored chert is most common though white and black chert are occasionally observed. Red occurs only rarely and then usually as mottling in specimens which are predominantly of other colors. Mottling occurs frequently, and banding, though not common, also occurs. The diameter of the cobbles are predominantly yellowish tan or a translucent grey on the interior (House 1975:82).

Morse and Million (1980:15-26) note that the Crowley's Ridge chert may be classified as either an agate or chalcedony. Agate, a type of chalcedony, is distinguishable by concentric banding which is the result of the filling in of cavities with silica (Vanders and Kerr 1967:260). Presumably then chalcedony refers to those cherts that display no banding. In any case, the Crowley's Ridge material is characterized by a wide range of physical features that reflect the variable origins of this chert.

Procurement of Lafayette chert gravels would have been a relatively easy task. No subsurface quarrying such as has been reported for the well known Crescent cherts of the Burlington formation in Missouri (Ray 1981) would have been required to obtain these gravels. Additionally they are loosely encased in a soil matrix, rather than cemented into conglomerates. Hillside erosion and water course dissection has exposed almost unlimited amounts of chert gravels on and along the margins of Crowley's Ridge. Morse and Million (1980:15-26) note that while "Much of the chert is too fractured for efficient use . . . only a short period is needed to search the various creek gravel beds to locate good quality chert". Based on the relative expenditure of energy involved in procuring Lafayette chert to procuring chert from other sources, it is no wonder that this material is encountered in proportionately high frequencies on prehistoric sites in the eastern Arkansas lowlands.

House (1975) has reported some observations of preliminary experiments with thermal alterations of Crowley's Ridge chert. He notes that much of the material exposed to heat turned "deep blood-red". He also has noted that this color seldom occurs in natural context on Crowley's Ridge, whereas at prehistoric sites in the lowlands "specimens of gravel chert which are red in color are quite common" (House 1975:84). Vanders and Kerr (1967:260) note that chalcedony, of which chert is a variety, will turn a deep red-brown when heat is applied if it has previously been impregnated by ferric hydroxide. Since this compound is a common constituent of soil water solutions, the color observations made by House on heat treated Crowley's Ridge cherts is probably a result of this catalyst.

Pitkin Chert

In central Arkansas the Interior Highlands rise above the Western Lowlands. The escarpment in this region is heavily dissected by numerous streams and rivers which flow south and east into the Mississippi Embayment. One of these rivers is the White, which separates the Ozark Plateau to the north from the Boston Mountains to the south. It is in the latter region that the White River and its tributaries have eroded and exposed the Upper Mississippian Pitkin Limestone Formation. It is in this formation that the distinctive Pitkin chert originates (Haley 1976; House 1975; Manger n.d.; Morse and Million 1980). House (1975) and Padgett (1978) note that Pitkin chert rarely is present on prehistoric sites east of Crowley's Ridge. This is a logical expectation given the probable energy investment involved in procuring this particular resource over such a distance (ca. 50 miles).

Pitkin chert is easily recognized by its distinctive black coloring. Novick and Cantley (1979:53) note that "Since Pitkin chert is virtually the only black chert in the area it is easily recognized". The best description of this chert type is given by Erwin (n.d.:85) who is quoted in House (1975):

The color does have a slight range from light blue of leached specimens through blue-grey and blue-black to black. Some of the chert appears to obtain a slight red cast after exposure to fire. Some specimens exhibit horizontal, nonconcentric banding of light and dark zones. Small white fossil inclusions, mostly crinoid stems, have been observed within a black matrix.

Another distinctive characteristic is the occurrence of zones in the chert which contain small (less than 0.5 mm in diameter) pits where calcite inclusions have weathered out. These pits are characteristically lined with an orange film which is probably iron oxide.

House suggests that the only way to visually identify Pitkin chert when found out of its natural matrix is by microscopic inspection. He states that a very fine-grained blue coloring is diagnostic of this chert type, but that it can be observed only under 20x to 30x magnification.

While Erwin mentions that Pitkin chert may turn slightly red when subjected to heat, more studies need to be conducted to identify the range of observable changes that thermal alteration may have on a representative sample (House 1975:85). Stanfield (1978:257) notes that Crowley's Ridge gravels will turn red on the cortex but retain their original brown coloring on the interior. It is also possible, however, that some of this material has been overlooked due to thermal alteration. If heat treatment proved to enhance the quality of Pitkin chert and if it was entering the Eastern Lowlands through mechanisms of indirect procurement (trade), then the thermal alteration process could have taken place prior to the exchange processes. This would be a logical procedure given a proposed increase in value of heat treated Pitkin chert. While this is strictly a hypothetical situation, it demonstrates the need to be aware of the range of possible variables involved in the transformation of natural resources into cultural contexts.

Boone Chert

On the north side of the White River in the Springfield Plateau region of the Ozark Plateau is the Early Mississippian age Boone limestone formation. It is in this formation that in situ sources of Boone chert occur. This, however, is not the only source of this material. Call (1891:28) notes that in this region, "Near the water courses numerous small valleys and gulches have been cut out, leaving between them hills and ridges with steep slopes covered with chert fragments". Padgett (1978) suggests that procurement of Boone chert occurred primarily at gravel bars, particularly in the White River, where Boone chert nodules occur intermixed with Pitkin chert. Residual deposits of Boone chert on the slopes adjacent to outcroppings of the Boone formation were also exploited by prehistoric groups (House 1975).

Descriptions of Boone chert vary, primarily because there is an overall lack of homogeneity in the appearance of this material. Manger (n.d.:212) states that, "The specific characteristics of the Boone chert . . . are so variable that they defy attempts to assign this material". Call (1891:27) describes this material as "white or grey on a freshly broken surface, but becoming brownish when exposed to weather". Jeff Otinger (personal communication) has examined samples of Boone chert and states that it is generally grayish white with a marble-like appearance. Padgett (1978:63) feels that Boone chert may have been misidentified, "due to the difficulty in separating Boone chert from similar cherts derived from sources in Illinois and Missouri". Stanfield (1978:287) suggests that thermal alteration of Boone chert results in no change in color. Alterations do occur, however, in the flaking quality of the material. It is therefore difficult to distinguish between heat treated and non-heat treated specimens of Boone chert.

It seems that the lack of decisive diagnostic features forces classifications of Boone chert on prehistoric sites in the Eastern Lowlands to remain tentative. More precise studies and means of identification, such as neutron activation, need to be conducted to isolate the distinctive characteristics of Boone chert. Similarly, heat treatment studies are needed to identify the range of characteristics exhibited by Boone chert which has been thermally altered.

Ozark Escarpment Gravels

Morse and Million (1980:15-16) briefly discuss the presence of chert gravel deposits on the Ozark Highlands adjacent to the Western Lowlands in northeast Arkansas.

There is a gravel deposit on the escarpment which is similar in altitude and appearance to that on Crowley's Ridge. The chert cobbles, however, are smaller and of relatively poorer knapping potential at an outcropping visited by Jim Price and Dan Morse in 1976. A collection of a similar gravel deposit was also found to be virtually identical to a sample from Crowley's Ridge.

The Crowley's Ridge Lafayette gravels are of Pleistocene age and are superimposed over very similar Tertiary age deposits (Branner 1891). An examination of a detailed geological map of the region indicates that no upland Quaternary gravel deposits exist along the escarpment. However, there are scattered Tertiary age sands and gravels that fit the distribution described above and appear to be similar to the Tertiary deposits of Crowley's Ridge (Haley 1976). It is probable that the chert gravels to which Morse and Million refer are of Tertiary age rather than Pleistocene age. This might explain the poorer quality of this material, compared to Lafayette gravels, since prolonged exposure to weathering would tend to reduce the favorable aspects of these upland Tertiary gravels.

The extent to which the Ozark Escarpment gravels would have been exploited by prehistoric groups is presently unknown. It would undoubtedly be extremely difficult, if not impossible to differentiate between these chert gravels and those from Crowley's Ridge and surrounding stream beds, once removed from their natural context. The probability that this material was utilized to any great extent by groups inhabiting the Eastern Lowlands would seem to be very low. However, this remains to be demonstrated.

Cotter or Jefferson City Chert

The Salem Plateau of the Ozark Highlands covers much of south central Missouri and extends south into extreme north central Arkansas. The geologic structure in this region is composed primarily of Ordovician age dolomites of the Cotter and Jefferson City Dolomites. While Haley (1976) does not distinguish between these two formations, Ray (1981) separates them but notes that they are very similar. Both formations contain extensive quantities of chert. Pending modifications in this report, Cotter and Jefferson City formation cherts will be considered synonymous. The lack of available distinguishing characteristics, the more-or-less identical distributions of these two formations and the apparent similarity of the cherts from the Jefferson City - Cotter dolomites substantiate this combination. As Haley (1976) notes, "The Jefferson City Dolomite and the overlying Cotter cannot be separated on the basis of lithology".

Ray (1981:188-189) divides the Jefferson City chert into three sub-categories based on morphological features, oolitic, banded, and mottled. The Oolitic variety is distinguished by the presence of small oolites that range from 0.5 to 0.75 mm in diameter. Concentric color bands of white, blue, brown, grey, black or purple are properties of the Banded variety. Mottled Jefferson City chert, "usually exhibits a streaked and swirled pattern or disturbed banded appearance". The most distinguishing characteristic of these cherts is that they rarely contain fossils, and when they do, the fossils are very distinctive gastropods that allow the separation of Jefferson City chert from other cherts that occur in adjacent areas (Ray 1981).

Novick and Cantley (1979:53) state that a light tan color is a feature of Cotter chert. This may provide a diagnostic characteristic for distinguishing between Cotter and Jefferson City cherts since Ray (1981) does not list tan

coloring as a property of the latter chert type. Instead, "blue, brown, grey, purple, pink, or white" are listed as the colors represented by Jefferson City chert. Color descriptions tend, however, to be somewhat subjective and isolation of additional traits need to be accomplished, if possible, before a typology can be constructed for these chert resources.

Padgett (1978) notes that cobbles of Cotter chert occur in the gravel bars of the White River. In Randolph County on the border between Arkansas and Missouri, the Jefferson City - Cotter Dolomite formation has been exposed extensively along the dissected escarpment of the Ozark Plateau. Such rivers as the Spring, which flows through this region and into the Western Lowlands, undoubtedly contain extensive gravel deposits of chert that has been eroded from this formation. These locations, along with adjacent hillsides, could have been easily exploited by prehistoric groups in the area. The importance of the Jefferson City - Cotter chert to inhabitants of the Eastern Lowlands is not well documented. Based on work by Padgett (1978) and Morse and Million (1980) it would seem that this resource was not heavily utilized in this area.

Penter Chert

Chert from the Penter formation is not extensively discussed in any of the archaeological literature dealing with lithic resources in this region. Morse and Million (1980) and Manger (n.d.) mention that it occurs in Middle Devonian context along the Ozark escarpment. Haley (1976) however, places it in the Lower Devonian Penter chert formation; this formation has extremely limited exposure on the northern side of the White River Valley, primarily in the area where it flows into the Western Lowlands. The most readily accessible source of this chert would probably be in the gravel bars of the lower White River.

Manger (n.d.:212) describes Penter chert as a white-tan, mottled, non-fossiliferous chert. Padgett (1978) notes that it is easily distinguishable from Pitkin and Cotter chert, but Morse and Million (1980) feel that Penter chert may often be confused with Boone chert which ranges from white to grey to brown (Call 1891). It appears that Penter chert was unimportant to prehistoric groups in the Eastern Lowlands. Padgett's data (1978:63) indicates that "The distribution of Penter chert . . . is restricted to the escarpment and Western Lowlands".

Burlington Chert

The Burlington formation is an extensive deposit of Mississippian age, highly fossiliferous limestone that outcrops in large sections of Missouri and Illinois. Within this limestone matrix large amounts of fossiliferous chert occur that have in the past been an important source of lithic raw material for numerous prehistoric groups inhabiting a wide geographic range (Morse and Million 1980; Ray 1981; Rick 1978; and Cook 1976). While the Burlington formation is not present in Arkansas, secondary deposits of weathered Burlington chert undoubtedly comprise a large part of the gravels of the Lafayette formation on Crowley's Ridge. Meyers (1970:12) describes the chert in the Burlington formations of Illinois as follows,

The Burlington is unusual for the large amounts of white and light-colored cherts it contains (Rubey 1952:43). This nodular chert occurs in lenses and irregular beds, one to eight inches thick and from a few inches to several feet long. The chert is highly variable in color and fossil content.

Ray (1981) notes that the most distinctive characteristic of Burlington cherts are the fossil inclusions that occur in abundance in this material. He states that the range of colors includes, "white, tan, buff, or light grey". Additional characteristics provided by Ray (1981) are that the chert is fine to coarse-grained, opaque, rarely banded and sometimes mottled.

Rick (1978) made an extensive study of the effects of heat treatment on Burlington chert. He notes that "the great variability in color and texture of unheated Burlington chert is a result of local variation in chert formation conditions of the Burlington limestone" (Rick 1978:21). Ray's studies indicate that thermally altered Burlington chert will, in most situations, turn pink or red. In addition to color he lists numerous other criteria for identifying thermally altered Burlington chert. The recognition of this material in unaltered or altered states should be relatively easy to accomplish given the wealth of data available on the physical and chemical properties of Burlington chert.

Morse and Million (1980:15-23) discuss the availability of Burlington chert to the prehistoric inhabitants of the northeast Arkansas lowlands. They mention the "Crescent Quarries" in eastern Missouri as a primary source of Burlington chert for early Mississippian groups in the Big Lake region. Undoubtedly this material was procured through channels of exchange during this time period, since a distance of approximately two hundred miles would have been involved to reach the source area. The degree of utilization of this material during other time periods by prehistoric groups in the Arkansas lowlands is not clearly known although it would appear minor.

Everton Chert

The Middle Ordovician Everton Formation outcrops in the Ozark Region of Arkansas north of the White River. This extensively exposed formation contains a type of chert which Manger (n.d.) has described as "Quartz, Interclastic-bearing chert". The structure of this material is highly distinctive and it is easily identified outside of its natural matrix.

The Everton Interclastic chert is essentially characterized by a conglomeration of minute quartz and chert grains, cemented by a silica structure. The quartz grains tend to predominate in the samples examined from the Steele site collection. They are completely colorless and transparent, sometimes constituting 50 percent or more of the internal structure of this material. They are generally round or oval although occasional angular fragments occur. The chert interclasts are similar in shape and size to the quartz interclasts. However, they occur less frequently in the specimens of Everton chert observed in this study and are translucent rather than transparent.

The color of Everton Interclastic chert is described by Manger (n.d.) as white to light brown. Specimens of pink-red, purple, and grey were observed in the Steele site collection as well as white and brown or tan. The structure of these color varieties, however, were identical, although flaking quality appeared to vary.

Novaculite

Arkansas novaculite occurs in the Ouachita Mountain region of southwest-central Arkansas, south of the Arkansas River. The deposits are late Devonian and early Mississippian formations (Haley 1976; Hoffman 1970; and Levin 1978), the distribution of which has been described by Williams (1959:71).

Novaculite is widely distributed in the Ouachita Mountains in southwestern Arkansas. Between 200 and 300 miles of narrow, more or less parallel, nearly east-west belts of novaculite crop out from Pulaski County westward to Oklahoma. The Novaculite formation which is Devonian in age, consists of novaculite, shale, and conglomerate, and has a thickness of from 250 to 900 feet.

Dunbar and Rodgers (1963:247) describe novaculite as a "very even textured rock made of microcrystalline quartz. Though aphanitic, novaculite is generally coarser in grain than true chert, and has a dull rather than vitreous luster". Williams (1959) notes that it breaks with a conchoidal fracture which makes it very suitable for stone tool manufacture. He further states that there are two separate varieties which he calls "Arkansas" stone and "Ouachita" stone.

The Arkansas stone is a very fine-grained homogenous rock with a waxy luster, is usually white, and is translucent on thin edges. The Ouachita stone is more porous and has the appearance of unglazed porcelain (Williams 1959:71).

Heat treatment studies of Arkansas novaculite have been performed by Flenniken and Garrison (1975). The results of this investigation indicate the thermal "alteration of the novaculite occurs on a microscopic level of the stone and manifests itself on the macroscopic level with improved flaking properties" (Flenniken and Garrison 1975:129). It would appear then, that a mere visual inspection of novaculite will not determine whether or not the material has been subjected to heat treating. Stanfield (1978:257), however, notes that novaculite, which was originally white, will turn to red only when subjected to a specific temperature.

The resulting flaking properties produced by thermal alteration of Arkansas novaculite are quite favorable. Flenniken and Garrison (1975:129) note a substantial reduction in the occurrence of hinge and step fracturing during the tool-making process, removal of longer flakes and better control, and a considerable decrease in the amount of force necessary to remove flakes.

Prehistoric utilization of Arkansas novaculite appears to have been substantial during various cultural-historical periods. Padgett (1978) suggests that the spatial range of the Toltec phase is very close to the distribution of novaculite on prehistoric sites and that this material was extensively traded throughout this region. House (1975) notes that other than "lithic resources from adjacent Crowley's Ridge and the Ozark Highlands, novaculite is the only exotic material which occurs in substantial amounts in the Cache River Basin".

The Ouachita Mountains are not the only source of novaculite that was exploited and traded by prehistoric groups in the Mississippi Valley. Morse and Million (1980) note the presence of novaculite from southern Illinois at the Zebree site in northeastern Arkansas. Harris (1981) has also found Illinois novaculite on sites in the Fourche Creek drainage in northeastern Arkansas and southern Missouri. Montet-White (1968) describes this material as a grey novaculite which occurs in both southern Illinois and parts of Indiana. This grey novaculite probably would have entered northeast Arkansas through trade, although the source area for this material is closer than the Ouachita Mountain novaculite.

Sandstone and Orthoquartzite

Sandstone occurs on prehistoric sites in northeast Arkansas in large quantities which may partially reflect the availability of this material to aboriginal groups in this region. Two primary sources of sandstone exist in northeast Arkansas, Crowley's Ridge and the Ozark Highlands.

The Tertiary deposits of Crowley's Ridge are exposed along the periphery of the ridge where House (1977:32) notes that, "Large chunks of hard sandstone suitable for use as mortars and anvils" occur. This source would have been particularly important to groups in the Eastern Lowlands where no other readily accessible sandstone occurs.

Morse and Million (1980:15-22) note that in addition to sandstone, there are considerable outcroppings of orthoquartzite on Crowley's Ridge. Klinger et al. (n.d.:406) define this material as "a rock type formed by sand-sized particles of quartz and a cementing agent. Presumably the once calcareous sandstones were replaced by silica. Fracture is even and usually conchoidal". This is reportedly a localized deposit which occurs northwest of Paragould, Arkansas where "sufficient stone (orthoquartzite) is present for the creation of rock shelters". Morse and Million (1980) state that the color of this material is very light red or brownish gray.

Manger (n.d.) discusses additional sources of "silica-cemented orthoquartzite" that occur in the Ozark Highlands in the Everton and St. Peters formations which outcrop adjacent to the Western Lowlands north of the White River. This is a highly pure, light colored sandstone composed of large, rounded, well sorted quartz grains that make up at least 90 percent or more of the material (Manger n.d.:212).

Considerable sandstone is available in the Ozark region. Outcrops of sandstone occur along the escarpment in the Ordovician Age St. Peters Formation, the Mississippian Age Batesville Formation, and the Pennsylvania Hale Formation (Williams 1959; Haley 1976). Additionally, Morse and Million (1980:15) suggest that "The St. Francis River allows access to a variety of sandstone in the Ozark Highlands to the north".

Soapstone

One fragment of a soapstone vessel sherd was recovered from the Steele site in unclear context. Williams (1959:80) briefly mentions the presence of soapstone "in Saline County, Arkansas, in altered serpentine intrusives that cut paleozoic shale and chert". He describes this material as, "a rock composed largely of the mineral talc with lesser amounts of other silicates and carbonates. The rock is either massive or flaky depending on the talc content".

Petrified Wood

A few fragments of petrified wood were recovered during the Buffalo Creek project. According to Padgett and Ray (1977) petrified wood occurs intermixed with sandstone, quartz, and chert gravels in Crowley's Ridge. The extent of petrified wood in these deposits is unknown. It is likely that the Buffalo Creek specimens came from this context; however, it is just as possible that petrified wood was traded into northeastern Arkansas from some other source.

Hematite

Hematite is a mineral composed of ferric oxide that may be dark brick-red or gray to grayish black. The structure can be a highly consolidated hard mass or soft, earthy material. The variety generally encountered in a cultural context is red ochre, which is always red and soft (Vanders and Kerr 1967). In certain soils the process of dehydration will result in the conversion of naturally occurring black limonite to red hematite. The red coloring is the result of oxidation of the iron component of this mineral when the soil matrix "dries out" (Brady 1974). Morse and Million (1980) suggest that this situation exists in Crowley's Ridge and the Ozarks. They note that "A primary source of hematite procurement therefore, is in the small creeks and other erosional cuts into such well-drained soil masses" (Morse and Million 1980:15).

CHAPTER 8

GENERAL TESTING PROCEDURES

Introduction

The Buffalo Creek Diversion Archaeology Project was designed as a multi-phase study program with two major objectives: (1) detailed evaluation of deposits at sites 3MS346, 3MS351, and 3CG847, and development of strategies for large-scale excavation as necessary, and (2) data recovery. To accomplish this the field effort was divided into two phases: Phase I and Phase II. Phase I of the project was directed toward the first of the above listed objectives, while Phase II was directed toward the second. A third phase, directed toward analysis of data recovered, ran concurrently with Phases I and II. Upon completion of field activities, Phase III continued in our office laboratory facility in Topeka, Kansas. Procedures utilized in Phase II will be described in Volume II of this report.

The Phase I testing program was a large undertaking and was administratively dominated by the urgency required by the project construction schedule. The project scope of work called for completion of testing within 30 days of initiation of fieldwork. This involved controlled surface collections of about 100,000 square meters, and excavation, based on sampling requirements of the scope of work of an estimated 581 one meter test units. This large amount of work in such a short time posed great administrative problems.

We tried to minimize these problems by detailed planning. First, an advance party arranged for prompt disking of the site areas and for housing and other amenities for a field crew of 45 individuals in predominantly rural area. A field laboratory was established in a vacant store in Leachville. Field supervisory personnel arrived June 29, 1981 and begun active field work planning. Approximately 20 screens manufactured in Leachville to our specifications, and other equipment (shovel, trowels, wheelbarrows, etc.) ordered through Leachville hardware stores, was collected and organized for the arrival of the field crew on July 6.

The field supervisory staff concentrated, however, primarily on initial site studies. All three sites were mapped, and a grid of 10 meter units flagged over the surface of each. Sites 3MS351 and 3CG847 were completely surface collected within these units, and the locations of initial one meter test squares were marked. Screens and excavation kits were placed beside these locations. The field laboratory was organized and equipped, and processing procedures established.

The crew, 36 field and 4 lab technicians, arrived the evening of July 5, and was assembled for work early on the morning of July 6. At approximately 8 a.m. a "runner" from the nearest telephone arrived with a message from the Corps of Engineers in Memphis that all contract arrangements had been finalized and signed by the appropriate personnel. We immediately began work.

We had realized that feedback from the field laboratory would be a problem. This became evident after the first week of excavations, when sites 3CG847 and 3MS346 began to appear to have less potential than initially projected, and 3MS351 began to appear to be complex and very significant. We immediately began to shift our efforts to 3MS351, but the lack of flexibility dictated by such a tight time schedule and large crew resulted in excavation of probably too many units at 3CG847 and 3MS346, and too few units at 3MS351.

A more detailed description of our Phase I study program is presented on the following pages.

Field Tasks

Task One: Contour Mapping

During the week preceeding the arrival of the crew, all three sites were contour mapped. Because of the low relief in the project area, a contour interval of 10 cm was selected for mapping. A grid system was established along magnetic north for all three sites, and used for subsequent surface collecting. All coordinates were measured south and east from an arbitrary ON/OE point. A section of one-half inch diameter lead pipe was set at the ON/OE coordinates as the on-site datum point at all three sites. This principal site datum was given an arbitrary 30.00 m elevation above mean sea level (MSL).

Task Two: Intensive Surface Collection

Task 2 involved intensive collection of the surfaces of the three sites. Previous surface collections during survey phase investigation were judged inadequate for defining site boundaries and intrasite variability. First, collections made during the survey did not have the benefit of uniform plowing. Second, distributions of artifacts noted in initial walkovers of all three sites did not match with the data provided by previous surveys. Third, original survey reference points necessary to establish original collection areas could not be found and probably had been plowed away. We thought it best to carry out intensive surface collections ourselves to be sure we had complete, up-to-date information.

Several weeks prior to the initiation of the fieldwork, all three sites were uniformly disked to insure maximum surface visibility. We were quite worried about adequate rainfall before the start of fieldwork, and artificial means of wetting the newly plowed sites were considered. Fortunately, however, soaking rains occurred the week before fieldwork, "weathering" the dusty surface and providing optimum artifact exposure.

We decided to use 10 meter squares as our surface collection units. This size was selected as a three-way compromise among field expediency, density detail, and map interpretability. As collection units are increased in size, logistics are simplified, but detail is lost. We felt the 10 m units were a good compromise between these two factors. The third factor involved is the general artifact density at a site. If artifact density is very low, larger units are needed to collect "mappable" data. Based on our preliminary inspection of artifact density at the three sites prior to fieldwork and on the previous survey estimates of the sites, we felt that 10 m units would provide interpretable data. While this decision was certainly subjective, we had no objective data available to indicate a better approach. Experience with similar site size/artifact densities at a number of Woodland sites in Missouri using 10 meter units (Brockington 1973, 1976), had produced good results, and this approach was proposed and utilized at two of the project sites.

Our procedure was to place, using a transit, two rows of parallel stakes at 10 m intervals along the right-of-way boundaries, and then to pull two ropes, marked at 10 m intervals, between the first two pairs of stakes, thus demarcating a row of 10 m squares. After the row was collected, the first rope was "leapfrogged" over the second rope and pulled between the third pair of stakes, demarcating a second row of 10 m square collection units. Flags were placed at the proper intervals, in effect gridding the entire site surfaces.

One site, 3MS346, was not surface collected in this manner. Like sites 3MS351 and 3CG847, site 3MS346 was examined after several rains. Virtually no surface material was found on any of these walkovers despite the near perfect collection conditions, and thus the original concept of a controlled surface collection for this site was altered. Because of the very low artifact density, exact flagging was thought to be more effective. The site was examined by a walkover of approximately 18 people spaced one arm's length apart. Artifacts were flagged in the field as they were collected. The resulting distribution of flags indicated an indistinct, very light surface scatter in the southwest corner of the site. No concentrations appeared that would warrant a stratified sampling of test pits based on the surface conditions alone.

Task Three: Test Unit Excavation

Fieldwork in Phase I initially involved excavation of test units at the three sites. Test units were 1 m square, excavated in 10 cm levels (or by natural stratigraphy when evident), with all material dry screened through 1/4-inch mesh hardware cloth. The project Scope of Work called for these test pits to represent a 0.5% sample of the site area. We placed the test pits within our general site boundaries using a stratified, unaligned sampling procedure. This involved dividing the site into a series of 200 square meter units and randomly selecting from each unit a one meter test pit. This method insured adequate dispersion of test pits while maintaining an unaligned posture so as to avoid accidental coincidence of the sampling plan with an archaeological community plan.

Artifact and feature data from these initial test pits were used in conjunction with surface collection data to define areas of high artifact density. Artifact density maps were made by hand in the field lab and high density areas subjectively outlined. These areas then had additional test pits placed in them, again using a stratified, unaligned approach, so as to bring the sampling ratio of these areas up to 1%.

Excavation of test pits was by hand using square point shovels and trowels, measuring tapes, line levels, etc. Most excavation was by shovel, with profiles and level bottoms cleaned by trowelling. All material was dry screened through 1/4 inch mesh, and samples were taken for flotation and 1/16 inch mesh screening from approximately 10% of the test pits. As the number of test pits was very large and most were very similar, only about half of the test pits were photographed, and stratigraphic profiles mapped. Descriptions of each test unit were made, however, and similarities among units noted. All features were mapped and photographed, and all feature fill was excavated by trowel and reserved for flotation and 1/16 inch mesh screening. Standard square-level, feature, and other forms were completed in the field.

When excavation of the one meter units indicated a probable concentration of materials, larger excavation units were utilized. These frequently took the form of two by two meter units, or a little larger, although in some cases individual one meter units were simply connected forming an irregular block excavation as seen on site 3CG847. The excavation of the larger two meter units was also prompted by soil conditions on site 3MS351. Excavations of the one by one units proved slow and somewhat inefficient. This was due to the dense clays and highly mineralized soils at that site which frequently had to be pick-axed through. One by one meter test units proved to be too small and confining to work in efficiently under these conditions.

Task Four: Backhoe Excavations

Our final effort during Phase I was to excavate backhoe transects at each of the three sites to test for deeply buried components and to provide sediment and pollen profiles for paleo-environmental analysis. Placement and extent of these was dependent on the results of our test pit program; high artifact density areas were avoided because of the potential destructive nature of backhoeing. Profiles were cleaned and mapped and soil and pollen samples removed where appropriate.

Other Procedures

Palynology

Pollen samples were taken from selected test pit and backhoe profiles, as well as from selected features. Pollen samples were analyzed using the Horowitz method, which utilizes large sample collection and heavy liquid extraction rather than acid baths and thus allows very good pollen recovery from traditionally unfavorable soils. We hoped to be able not only to provide a pollen profile (paleo-environments) for the sites, but also to gather critical data on the use of plant foods, particularly corn. Corn pollen has not been recovered in previous excavations at Late Woodland and Mississippian sites in the region, probably because of poor preservation (Morse and Morse 1980). As will be seen later in this report, pollen was not well preserved on the sites.

Pedologic Analysis

A pedologic analysis of all three sites was conducted to characterize the morphological, physical, and chemical properties of the soils, and to provide a stratigraphic and pedologic basis for artifact distribution and geologic history of the sites. This analysis was carried out by soil scientist Dr. John E. Foss. This analysis took place toward the end of Phase I when the sites were most fully exposed for pedologic interpretation. At this time soil samples were taken from selected test pit and backhoe profiles for laboratory analysis. Additional pedologic fieldwork took place in September, 1981 during Phase II.

Morphological descriptions were made on representative soil profiles according to methods established in the Soil Survey Manual (Soil Survey Staff 1951) and described by Foss et al. (1980). Detailed and general descriptions were made of approximately 40 profiles at the three sites investigated; however, the emphasis was placed on site 3MS351 as it was clear toward the end of Phase I that this site was the most complex both pedologically and archaeologically.

Particle-size analyses of sand, silt and clay were determined by the hydrometer method, and the sands were further analyzed by sieving. The sand fractionation included very coarse sands (2 to 1 mm), coarse sand (1 to 0.5 mm), medium sand (0.5 and 0.25 mm), fine sand (0.25 to 0.10 mm), and very fine sand (0.10 to 0.05). Some of the sand fractions were examined under the microscope to determine the percentage of concretions.

Extractable Ca, Mg, P, and K were analyzed by methods described by Bandel and Rivard (1975). Soil pH was determined by a pH meter using a glass electrode. Organic matter was determined used the Walkley Black method.

Features

Efforts were made to excavate features completely when they were encountered. Unfortunately, only 33 features were cataloged for all three sites during Phase I. This is probably in part due to the nature of prehistoric occupations at the sites, but also we are convinced to the soil conditions present. Porous sands resulted in the leaching away of characteristic soil discolorations which might indicate a feature. Further, at 3CG847, reworking of site deposits by wind action probably destroyed evidence of features that may have once been present. When located, feature plan views and profiles were drawn and specific feature forms were completed. A Munsell soil color chart was used to maintain soil color control. Feature fill was troweled out and floated in the field.

Unfortunately, only four of the 33 features were aboriginal. No prehistoric features were found at site 3CG847. Only one was documented for site 3MS346 and three for site 3MS351. The remaining "features" were either root disturbances (15) or recent historic disturbances (14).

Other procedures, such as flotation and water screening, were utilized principally during Phase II. These will be described in the procedural section of Volume II of our report. It should also be pointed out that virtually no carbon was found during the project. As previously indicated in Chapter 6 a radiocarbon date was derived from samples of bone associated with a relict channel at site 3MS351.

Magnetic Survey

A magnetic survey was conducted over portions of sites 3MS351 and 3CG847 to obtain information relative to site size and buried features. The instrument used was a Geometric G-816/826A portable magnetometer with a digital readout display. This model has the capacity to be used at a sensitivity interval of either one gamma or 1/4 gamma. The sensor was fitted with an expandable eight foot staff. Readings from the unit were hand recorded.

Items expected at an archaeological site that are detectable magnetically include: (1) ferric materials; (2) fired features (hearths, burned structures, concentrations of ceramic, etc.); and (3) unfired features (refuse pits, house floors, walls, midden, etc.). The expected presence of features at 3MS351 and 3CG847 suggested the usefulness of the magnetometer as a research tool.

Magnetometer surveys of other prehistoric sites suggest that distances between measurements on the order of one meter to two meters produce reliable data (Arnold and Kegley 1977; Weymouth 1976). Ideally, the survey transect spacing and the recorder interval spacing should be the same linear distance. This system, however, is not always practical as a field technique (Glander 1981).

During the survey, magnetic readings were recorded at one or two meter intervals along designated grid transects established for the surface collection of the sites. The grid spacing was accomplished by marking two meter intervals along a nylon rope with nonmetallic paint. Upon the completion of each transect the rope was removed to the next transect to be surveyed.

Site 3MS351 was chosen to be surveyed because it was originally defined by the previous survey as the smallest of the three sites and would thus provide a manageable experiment. The initial intent was to survey magnetically the entire site at a 1 gamma sensitivity level prior to surface collecting. Because the previous survey did not leave any permanent reference or datum points for any of the sites, the location of site 3MS351 as depicted in crude field maps could not be determined, and initial, subjective surface artifact distributions had to be used as an indicator of site location and to aid in deciding upon an area to magnetically survey. Unfortunately, it was later determined during Phase I excavation that observable surface distributions of artifacts had been affected by the New Madrid earthquake of 1811. Several areas of the site were covered by extruded sand, to some degree masking the true surface artifact distribution (making it appear smaller). For these reasons the area covered by the magnetometer survey was about fifty percent of the final total site area as determined by excavation.

A second area was chosen at site 3MS351 for a more intense magnetic survey. The area was a 20 x 20 m block located about 40 meters east of the last site-wide magnetic transect. The block was chosen because the area initially appeared to have the highest density of artifacts compared to other areas of the site. The intervening area between this block and the last magnetic transect was not surveyed because of time constraints before intensive, controlled surface collecting began.

The intent of the block survey was to identify any potential features thought to be associated with a higher density of surface artifacts. The block was first surveyed every meter at a sensitivity level of 1 gamma. Upon completion of the survey, the block was immediately resurveyed at a sensitivity

level of 1/4 gamma. The results were then compared against each other.

Upon completion of surface collecting site 3CG847, a portion of that site was magnetically surveyed prior to test excavations. The portion surveyed was one of two widely separated artifact clusters. The procedures followed for the block on site 3MS351 were followed for the similar block on site 3CG847.

A contour map was hand drawn after completion of the magnetometer survey. Once an anomaly was located it was marked in the field for eventual testing, either by test pit excavation or hand coring. To check this field interpretation, magnetic values were plotted using a Surface II computer mapping program (Sampson 1978) during our analysis phase. With this program, anomalies can be analyzed according to intensity, configuration, and association with other anomalies. These data, plus available historic information, are used in chapters below in assessing the potential for correlating magnetic anomalies with cultural phenomena.

Field Laboratory Procedures

In our field laboratory, which ran concurrently with the fieldwork, specimens collected from the surface were cleaned, sorted, and tabulated, and field maps were prepared showing densities of various artifact categories. Using these maps we delineated clusters indicative of components and general site boundaries. During Phases I and II, excavation unit bags were brought into the lab, entered into a "check-in" book, and then washed and sorted for cataloging. As each level bag was cataloged, consecutive numbers were assigned.

The Arkansas Archeological Survey cataloging system consists of three major divisions: lithics, historic, and prehistoric ceramics. These in turn are sub-divided into various general headings. Each artifact was linked with the date (81), the site code [either 1029 (3MS351), 1030 (3MS346), or 1031 (3MS847)], the catalog number the field artifact bag had been assigned, and a general artifact type number (eg., 1 equals projectile point). A point from site 3CG847 provides the following example: 81-1031-14-1.

Analysis Methods

Lithics

Lithic artifacts were subdivided into a number of categories for analysis purposes. Debitage was first sorted out and then divided into flake and shatter groups. Flakes were then categorized as primary decortication, secondary decortication, or interior flakes. Raw material was noted, as was color, heat-treatment, and presence of fossiliferous inclusions. Each category was then weighed and counted.

Bifacial and unifacial tools, cores, and projectile points/knives were sorted and described by raw material, color, and heat-treatment. Detailed morphological/functional characteristics of each of these categories were noted, and projectile points were assigned to cultural historical types as possible. Very few lithic tools were recovered from sites 3MS346 and 3CG847. Consequently, most of our detailed lithic analysis is presented in Volume II of this report which deals with site 3MS351.

Ceramics

All ceramics brought into the lab were screened through a 1/2 inch mesh screen. This technique was used at the Zebree site and was adopted for this analysis. Morse et al. (1980) note that little useful information is obtained from these small sherds when other larger sherd counts are available. It was felt that these small residual sherds would not provide enough information to warrant the time necessary to sort and catalog the artifacts.

These residual ceramics were classified by temper type. The weight for each temper type was measured in grams for each provenience unit and recorded. These materials were routinely checked during sorting and weighing for exotic surface treatment or other unexpected treatments. None were found.

All other ceramics larger than 1/2 inch were sorted, counted, and weighed for each provenience unit. Standard ceramic attributes were recorded, including tempering agent, exterior/interior surface treatment, rim/lip treatment, wall thickness, and interior/exterior color. When possible, calculations defining vessel capacity, size, and shape were made. Calculations were based on the formulas presented by Morse et al. (1980) for the Zebree project. Unfortunately, only two vessel portions were large enough to attempt to determine these variables. Both were from site 3MS351.

Miscellaneous

This category includes mostly historic debris, and was divided into classes such as glass, ceramics, metal, etc. All the artifacts were measured by weight for each provenience unit. Because the artifacts were determined to be no more than a few years old, no attempt at analysis beyond spatial distribution was made. Spatial analyses correlated well with the previous structures known to be on the sites.

Analytical Data Storage System

The large amount of artifact data generated by the Buffalo Creek Diversion Project necessitated an automated data storage system. This was especially the case as one of our primary research interests was analysis of surface and subsurface distributions of artifacts at each of the three project sites; this analysis could feasibly be attempted only through computer manipulation and automated plotting. We were aware of several available statistical and mapping routines, and we planned to use primarily SPSS for statistical analysis and the SURFACE II mapping programs for spatial analysis. Consequently, we attempted to format our data to fit the input needs of these packages. Initially, our thinking was dominated by the need for spatial analysis, and this conditioned the setting up of our coding system. We assumed that, if our system was standardized and uniform, we would be able to move quickly into more standard statistical analysis. In retrospect, more initial attention should have been paid to the needs for statistical analysis other than computer mapping. In several ways the organization of the data made certain statistical analysis difficult, and in certain cases we had to return to the artifacts for more detailed or simply different, organization of the data. The real lesson for us was that, even though we had considerable experience in several aspects of computer assisted archaeological data analysis, a project the size of the Buffalo Creek Diversion Project should involve a specialized expert in modern data base management systems.

Our data storage system involved coding information on punched cards for eventual storage on magnetic tape and disk. We made arrangements to use the mainframe Honeywell system at the University of Kansas near our Topeka, Kansas laboratory, where SPSS and SURFACE II systems were available. Our basic unit of analysis was the provenience unit: a surface collection square, or a level of an excavation unit. For each provenience unit, a series of cards was generated. Separate cards were used for

Lithic debitage	Ceramics
Unifacial tools	Groundstone tools
Bifacial tools	Microtools
Projectile points	Miscellaneous (historic)

Each card described that part of the assemblage for that provenience unit. For example, a lithic debitage card for a given provenience unit would contain entries listing the number of flakes, the number of shatter fragments, the number of primary and secondary decortication flakes, the number of interior flakes, and numbers within several raw material categories. This system worked very well for spatial mapping, but had drawbacks in that the data were not logically nested. For example, we could quickly tabulate the numbers of different kinds of flakes and the number of different raw materials, but it was not possible to associate logically a specific raw material with a specific flake type.

Statistical and Spatial Analyses

We planned not to employ complex multivariate statistical analyses of data from the three project sites. Instead, we attempted to focus on easily understandable tabulations and category comparisons, with an emphasis on visual interpretation of displays of spatial distribution data. We used exclusively the SPSS routines to generate descriptive statistics for various artifact categories. SURFACE II, a powerful computer mapping program developed by the Kansas Geological Survey (Sampson 1978), was used to generate artifact density maps for each of the sites. We used one of SURFACE II's simplest, most straightforward interpolation routines, and have reproduced output plotter maps directly. We avoided choroplethic (SYMAP) type procedures because these would not be applicable to our subsurface (sample-based) maps, and we wanted to display all maps in the same format. Maps, tabulations, and interpretations of these are presented as appropriate in the chapters to follow.

CHAPTER 9

TESTING AT SITE 3MS346 (JACKSON SITE)

Introduction

Site 3MS346 is located in the western portion of Mississippi County, Arkansas about 1.2 km west of the junction of the Honey Cypress and Buffalo Creek drainages. Located on and in a buried sand dune, site elevation is approximately 71.0 meters above mean sea level. The site lies in an open field (channel plug) marked topographically by a low rise toward the northwestern quadrant of the site area (Fig. 9-1). This field is bounded east and west by excavated portions of the drainage canal comprising the Buffalo Creek Diversion project. To the south the canal plug terminates in a cultivated field; to the north, at a county road (Fig. 9-2). The spoil banks paralleling the drainage ditch are about 7 to 8 meters high. The site is restricted to the dune area (Fig. 9-2) of the channel plug.

No historic structures were located on the site according to local informants. This was substantiated by United States Geological Survey (USGS) maps dated 1932, 1941, 1943, and 1956. Earlier General Land Office maps and drainage district maps also showed no structures on the site. Immediately across the county road north of the site a few houses were located in the 1950s. Local informants also indicated that a portion of the site area was possibly used to corral a few pigs during this period. Undoubtedly the few scattered historic artifacts located along the northern margins of the site reflect these former houses.

Soil Morphology

Pedologic analysis showed the site to be dominated by three major groups of soils (Fig. 9-2). The first soil type characterizes the principal feature of the site, a buried sand dune (Fig. 9-2; Table 9-1). The dune was composed of wind sorted fine sandy loam sediments which are moderately well drained to well drained. Additionally, dune profiles showed the development of lamella (Fig. 9-3). The second soil type (Fig. 9-2; Table 9-1) is an area heavily influenced by the New Madrid earthquake. The area is commonly covered with 20 to more than 100 cm of sand over the original surface. Unlike the dune area, this area is moderately well drained to poorly drained. The third soil type is composed of poorly drained sandy loam sediments covered with a thin veneer (less than 20 cm) of mixed earthquake sands.

The location of the site appears to fit the pattern of aeolian dune formation along the flanks of relict braided channels predicted by Saucier (1978). Site 3MS346 is located approximately one meter above a former relict braided channel which flowed a short distance to the east, along the north and east side of site 3MS351 (Fig. 9-4). Dated turtle bone from these same deposits suggest an active stream flowing approximately 7254 years ago. This date corroborates the pedologically suggested optimum time for dune development for site 3MS346 as being approximately 6000 to 7000 years before present. This period of development is implied by two factors: (1) the thickness of the lamella deposits, and (2) the color (Fe induced) of these deposits.

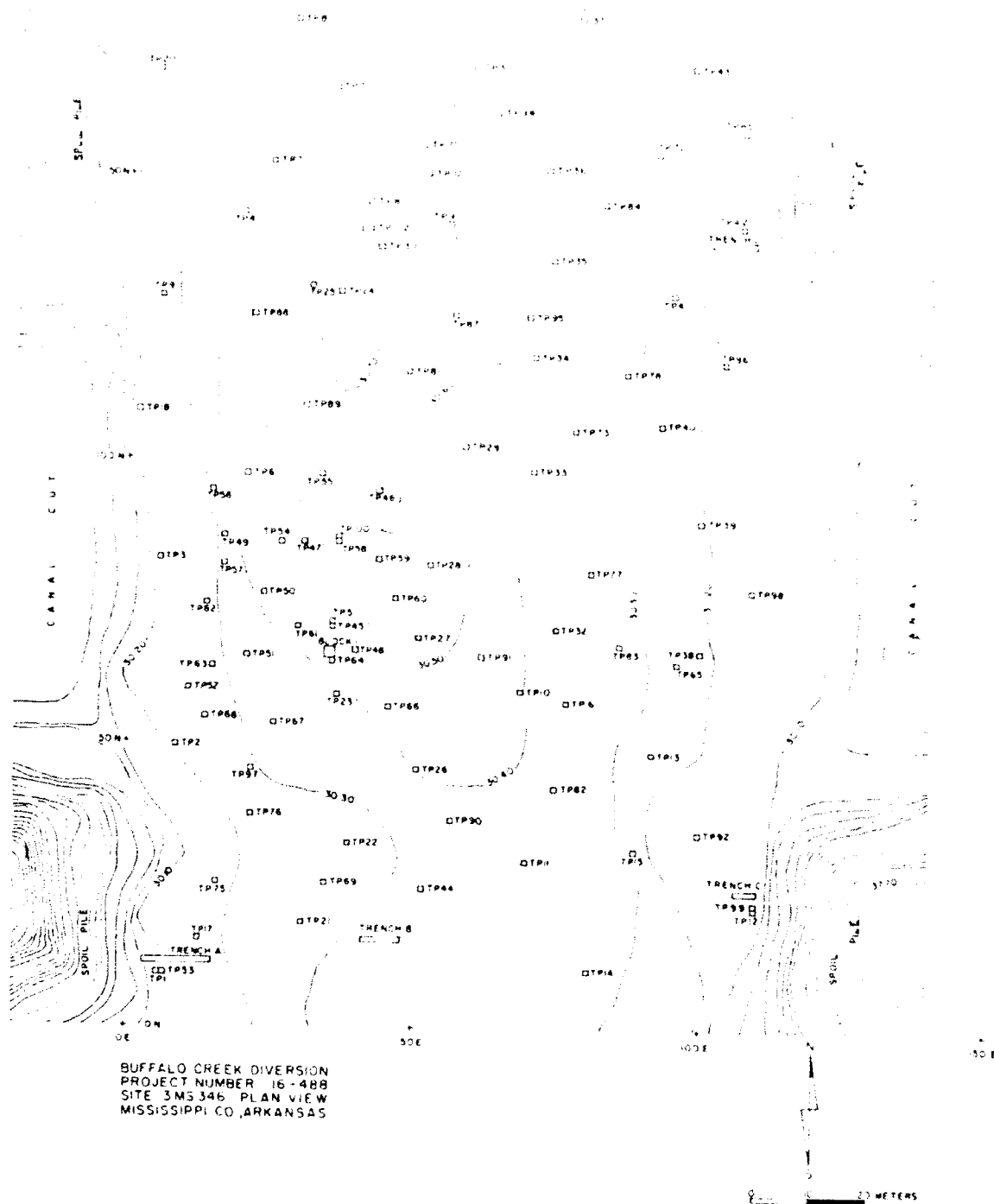


Figure 9-1. Contour map of site 3MS346 showing location of test pits and backhoe trenches. Contour interval is 10 cm.

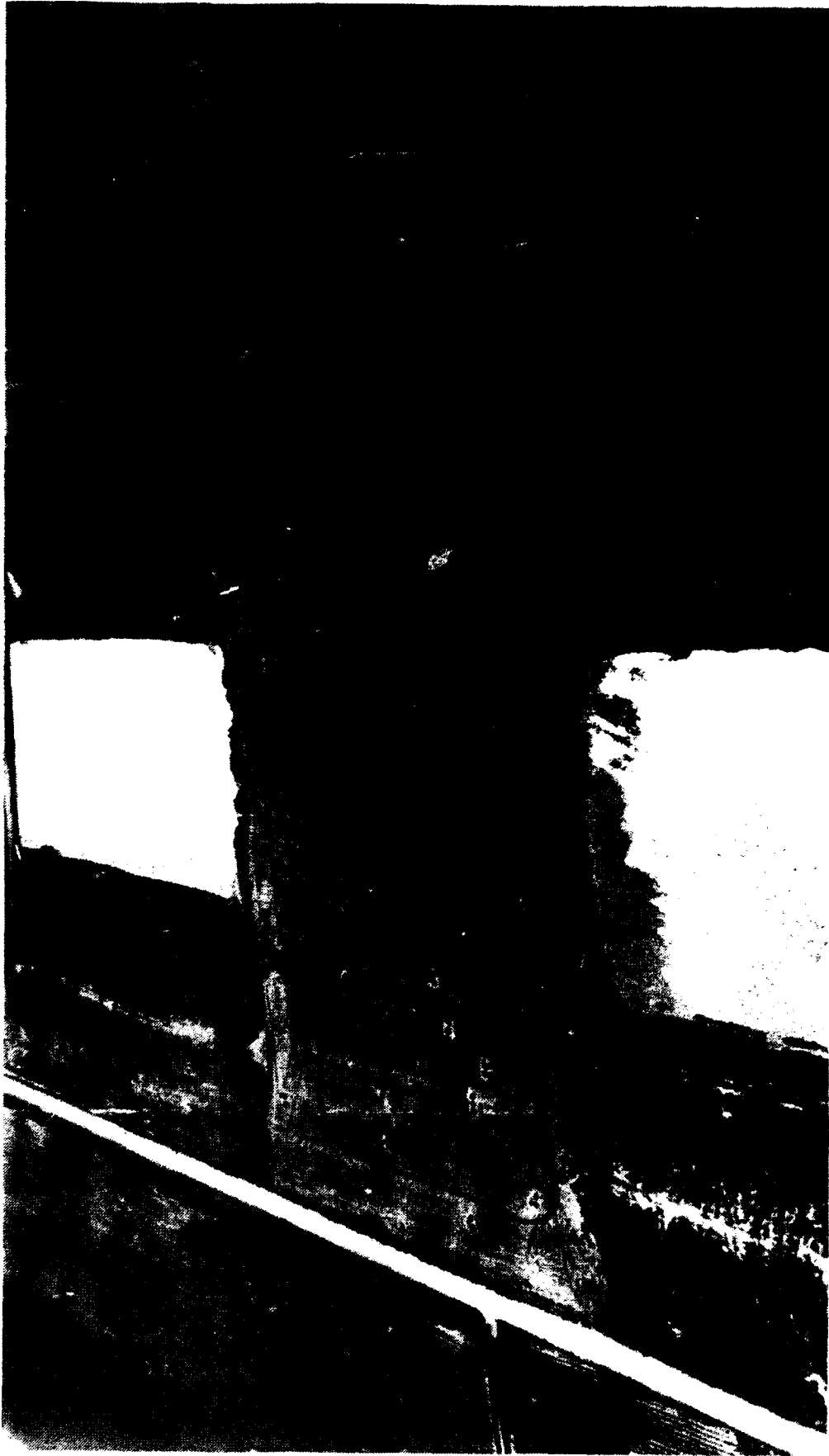


Figure 9.2. Site 3MS346, oblique air photo with view to the east. Soil groups, keyed to Table 9-1, are superimposed.

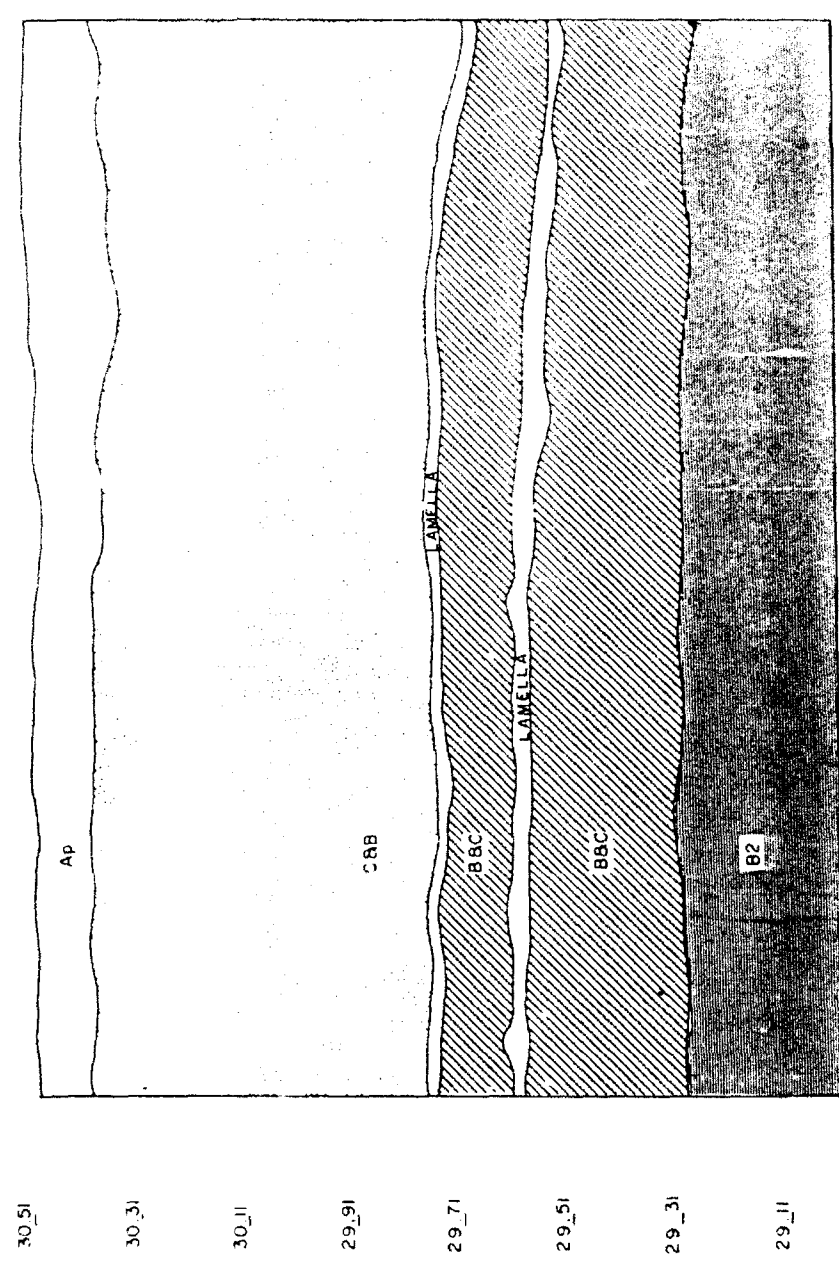
TABLE 9-1. SOIL MAPPING UNITS AT SITE 3MS346

<u>NO.</u>	<u>Description</u>
1.	Probable area of wind-sorted fine sandy loam sediments, moderately well drained to well drained.
2.	Area influenced by earthquake activity with 20-100+ cm of sand covering the original surface. Somewhat poorly drained.
3.	Sandy loam sediments with a thin mantle of earthquake sands on the surface, 0-20 cm. Somewhat poorly to poorly drained.

72N 36E
+

71N 36E
+

70N 36E
+



- BROWN FINE SAND 10 YR, N 4/4
 - YELLOWISH BROWN SAND TO DARK YELLOWISH BROWN SAND 10 YR, N 4/4
 - LAMELLA BANDS 7.5 YR, N 4/4
 - YELLOWISH BROWN SAND 10 YR, N 4/4 WITH BROWN SANDY LOAM
 - BROWN SANDY CLAY LOAM 7.5 YR, N 4/4
- BUFFALO CREEK DIVERSION
PROJECT NUMBER 16-488
SITE 3MS 346
TEST PITS 5 & 45 EAST PROFILE
MISSISSIPPI CO., ARKANSAS

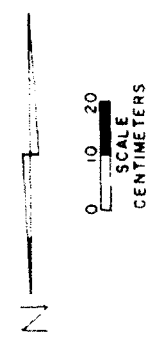


Figure 9.3. Soil profile in dune area, 3MS346, showing lamellae.

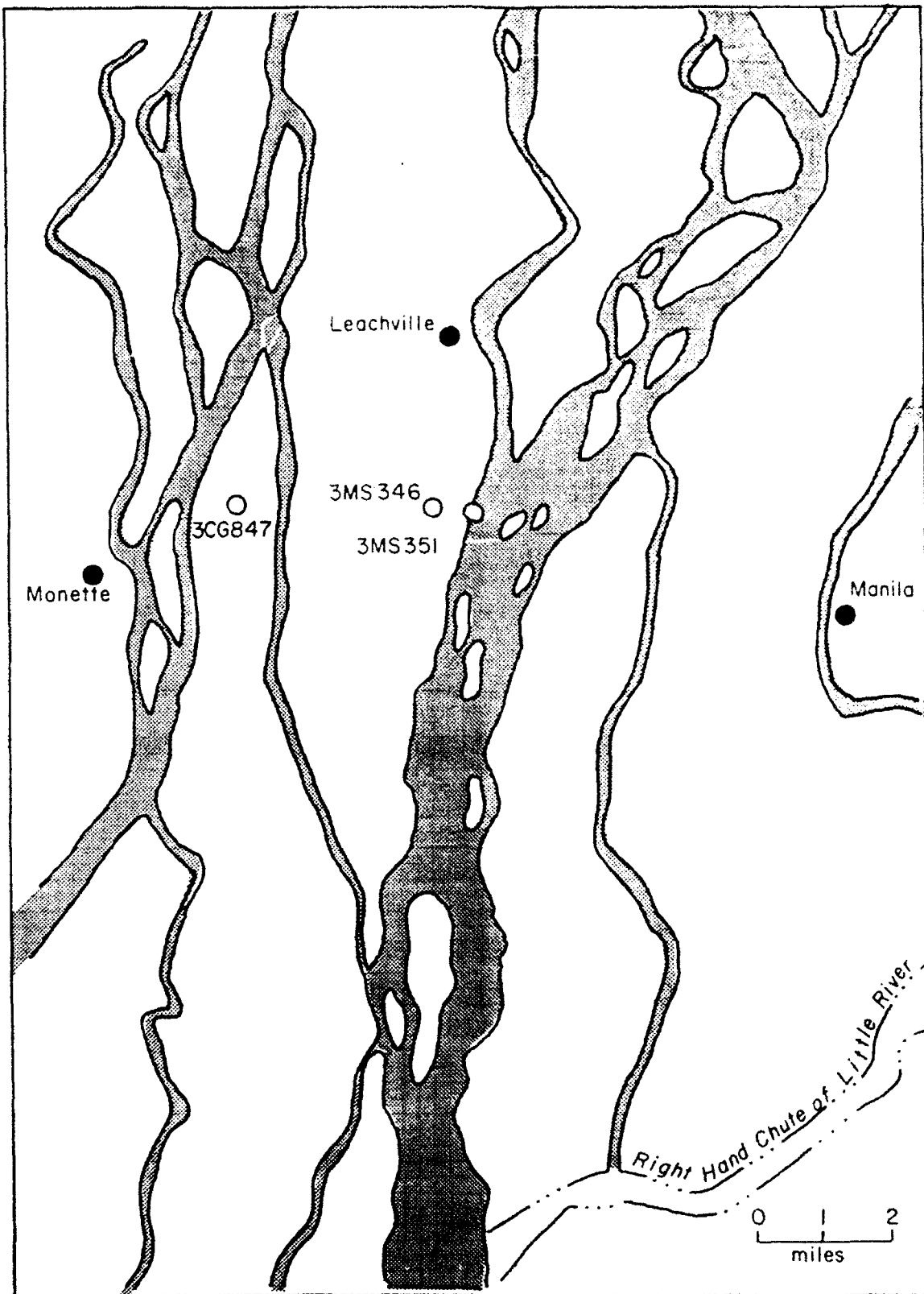


Figure 9-4. Distribution of alluvial deposits (braided stream channels) near Leachville.

The use of lamella development as a potential dating tool has been developed by Drs. John Foss and S. A. Segovia in the Richard B. Russell Reservoir area along the Savannah River in South Carolina and Georgia. In this continuing study, known archaeological dates were correlated with pedologic data resulting in an historical stratigraphic model of lamella development. The applicability of these data to areas outside Russell Reservoir is as yet undetermined, although the lamellae certainly indicate a considerable age for the 3MS346 dune, and the lamellae-based date of 6000-7000 B.C. fits well with the braided stream date from 3MS351 nearby and Saucier's (1978) theory of dune formation in this area. Further, the lamella indicate that the dune area at 3MS346 has been stable over several thousand years.

Post Depositional Impacts

The site has been under intensive cultivation since land clearing took place during and preceding the 1920s. Plowing has resulted in a 15 to 25 cm deep plow zone over the site. The combination of land clearing and cultivation has led to erosive wind action. Although unsubstantiated by field data, one local informant suggested that within his memory the site area was as much as one to two feet higher than at present. This claim is probably justified when viewed in terms of its geological location and soil development. The soils are composed of very fine grained sands (0.25 to 0.10 mm) which are subject to severe wind erosion. As previously noted, sites located on dune sands frequently show a mixture of cultural deposits due to dune migration, or more appropriately for this site, dune deflation. Plowing, under these soil conditions, only aids in erosion by breaking up the ground surface and exposing more of the surface to the wind.

Rainfall is also a factor contributing to site erosion. The problem is enhanced, in fact, by cultivation techniques. Both soybeans and cotton are row crops. Rainfall during the growing season typically comes in relatively short and heavy bursts. Although much is absorbed by the porous soils, excess rain quickly runs off the field between the crop rows. Surface soils are carried with this runoff, as are occasional artifacts.

The other impact on the site was the New Madrid earthquake of 1811-1812. Probably the most impressive aspect of the earthquake, and also the most destructive, are the sand dikes or blow holes. Figures 9-5 and 9-6 show a prominent dike located in Trench D in the northeastern quadrant of the site area. Other lesser dikes and fissures are scattered around the base or perimeter of the dune area. Principally, the effects of the earthquake were vertical displacement and redeposition of formerly buried sands extruded by the earthquake. A stratum of white sand several feet thick underlies much of the Eastern Lowlands. When the earthquake occurred, much of this sand was extruded along with water, covering parts of the site off the dune area by as much as one meter of sediments. Probably as a result of this extrusion, localized land subsidence took place. In the southeast quadrant of the site, vertical displacement of up to 10 cm apparently took place.

Regarding actual artifact displacement on the site, the effects of the earthquake were probably negligible. This seems to fit with other data documented by Morse (1973) and Morse and Morse (1980). The primary effect of the disturbance was to bury much of the perimeter of the site area i.e., the low lying areas around the base of the sand dune on which the site was located. Except for one small sand dike adjacent to Block 1, site 3MS346 was affected minimally by the disturbance. The finding of undisturbed lamellae discussed above strongly indicates that deposits were not greatly disturbed by the shocks



Figure 9-5. Sand blow hole profile in Backhoe Trench D, 3MS346.

and wave action undulations reported.

Factors influencing artifact preservation are soil texture and soil acidity. The site soils are sandy, porous, well drained, and highly acidic. This could account for the almost total lack of bone and other organics found on the site, the leaching away of any soil stains defining features, and the highly weathered ceramic assemblage. Also, the very fine sands which compose the site are subject to severe wind deflation. During the fieldwork, the upper 5-10 cm appeared to take on the consistency of talcum powder in periods of dry weather. Deflation is seen as the single most prominent destabilizing factor on the site. This would account for the mixture of Woodland and Mississippian ceramics, and, even at the deepest levels of the site, weathered ceramics which were frequently found "edge-on", rather than lying flat as typically expected in an undisturbed environment.

Testing Program

After disking of the canal plug area and appropriate weathering of the surface, initial walkovers of 3MS346 were made to obtain a general impression of site boundaries and to allow decisions to be made regarding placement of a surface collection grid. These walkovers indicated very few artifacts on the surface; because of this extremely low density the plan for intensive surface collection within units was altered. Instead, we conducted a 100% walkover, using a crew of 18 persons spaced approximately 2 meters apart. Wire flags were placed at the location of each surface artifact. No concentrations of artifacts were noted, and only 22 specimens were located over the entire canal plug area. A very subtle, light artifact scatter, however, appeared to be present in the central-southwest part of the canal plug area. This area, after pedological analysis, was interpreted as a dune area (see above discussion). Because no concentrations were present, a .05 percent sampling level was chosen for the entire canal plug area, with the goal of uncovering possible subsurface remains that were not evident on the surface.

This was accomplished by random selection of a single one-by-one meter test pit from pairs of ten-by-ten meter squares (200 square meters) on the site grid. Upon completion of this sampling over the entire area additional test units were placed in areas discovered to have a relatively high subsurface density. Placement of these units increased the sampling percentage to 1.0 percent in areas of high artifact density. The distribution of test units is shown in Figure 9-1. For the entire site, a total of 94 one-by-one meter units, two one-by-two meter units, and a two-by-two meter unit (Block 1) was excavated. Test pits were routinely excavated (in 10 cm levels) to 70 cm below the ground surface. If artifacts were still encountered at this depth, additional levels were excavated until a sterile level was completed. Four sediment profiles were also excavated by backhoe on the perimeters of the site.

Test pits placed outside the dune area were relatively unproductive (Areas 2 and 3, Fig. 9-2). Pedologically, the profiles are similar. They are composed of moderately to poorly drained sandy loam. Earthquake sands were noted in test pits around the perimeter of the channel plug. In all cases attempts were made to penetrate the earthquake material to test the former surface. Testing these buried deposits revealed virtually no cultural material. No prehistoric cultural features were discovered in any of the units outside the dune area. Five recent historic features were cataloged in this area (Table 9-2).

Test pits placed on the dune area (Fig. 9-1) revealed a small, heavily mixed and eroded sample of Late Woodland (Barnes) and Early Mississippian (Big Lake) ceramics. Stratigraphically, all test pits in this area are similar to one another. Unlike the poorly drained off-dune soils, the profiles indicated a well-drained sandy loam with well developed lamella (Fig. 9-3). No intact cultural features were found in the sand dune units, although one disturbed, small ceramic cluster was discovered in Test Pit 45 (Table 9-2, Feature 5).

Four sediment profiles were excavated by backhoe. All were placed outside the dune area. Backhoe Trench D (Figs. 9-5, 9-6) exemplifies the stratigraphy found off the dune. From the surface of the exposed face is the modern Ap horizon (plow zone) overlying the earthquake deposits of 1811/1812. These earthquake deposits were about 50 cm deep in Trench D, but they became deeper as one moved east along the northern boundary of the channel plug. The following sediments were composed of the buried IIA horizon, followed by a developed series of B horizons. The C horizon extended to the limit of the backhoe excavation units. The origin of the extruded earthquake sands could not be reached with the backhoe. No artifacts or signs of cultural activity were seen in any of the backhoe trenches.

After completion of the initial site testing, a small block excavation was opened on the dune area. Block 1 was excavated because the small amount of ceramics from the site were densest in the dune area, and because it enabled a check of the apparent heavily mixed Late Woodland/Early Mississippian ceramics throughout all levels of the dune area. No cultural features were encountered. The block excavation also substantiated the mixture of the two occupations.

No pollen samples were processed from 3MS346, although such samples were taken from the dune area. Based on analyses of similar data on sites 3MS351 and 3CG847, it was felt that additional analysis of less than ideal pollen samples was not necessary. No carbon samples were discovered during the excavations of the site.

Flotation samples were taken from all features and were also taken on a selective basis from general excavation levels in the dune area. None of the floated samples contained any material. Poor results are attributable to the general lack of cultural materials and the generally sandy acid soils of the site created by heavy fertilization of the site area.

Ceramic Analysis

Late Woodland and Early Mississippi occupations are the only components represented by the ceramics at site 3MS346 (Table 9-3). The total non-residual (1/2 inch or greater) sherd count is small; 692 sherds were counted from excavated contexts at the site. Only 215 sherds (31 percent) were counted for the Late Woodland component; 476 sherds (69 percent) were counted for the Early Mississippi component. As previously discussed, these components were heavily intermixed (Figs. 9-7, 9-8). Most sherds were not much larger than an inch (25 cm) in diameter and were heavily weathered.

TABLE 9-2. FEATURES AT SITE 3MS346

Feature Number	Horizontal	Vertical	Feature Type	Time Period	Artifacts
1	9N/5E	29.66-29.58	Tree	Recent Historic	Absent
2	97N/20E	30.20-29.85	Post	Recent Historic	Round Nail
3	106N/92E	30.25-29.88	Post	Recent Historic	Piece of Plastic
4	106N/92E	30.27-30.15	Tree	Recent Historic	Absent
5	71N/35E	30.01	Ceramic Cluster	Early Mississippian	Varney Red- Finned- Neely's Ferry Plain
6	24N/51E	29.93-29.68	Tree	Historic	1 chert chip (Crowley's Ridge chert) 1 shell tem- pered sherd
7	89N/99E	29.98	Plow Scar	Recent Historic	Absent

TABLE 9-3. DISTRIBUTION OF CERAMIC SHERDS AND LITHIC DEBITAGE, 3MS346

Levels	Sand-Tempered Sherds				Shell Tempered Sherds				Other Sherds		Total Sherds		Flakes and Shatter			
	Plain	Cord	Uniden- tifiable	Other	Total Sand	Plain	Slipped	Uniden- tifiable	Other	Total Shell	Chert	Quart- zite	Ortho- Quart- zite	Other	Not Heated	Heated Flakes
	11	5	3		19	29	7	1		30						
1	11	5	3		19	29	7	1		30	24				23	1
2	11	12	10	1*	34	24	7	7		38	20			1	20	1
3	34	14	10		58	127	16	7	4***	154	26	2			25	3
4	26	4	7		37	78	3	5	4****	90	16	1			17	17
5	13	11	8	1**	33	65	13	9		87	4	2			5	1
6	2	3	2		7	35	1	2		38	4	1			5	5
7	4	4			8	21		0		21	2				2	2
8	6	3	1		10	7		2		9	1	1	1		2	1
9	1				1	1	1			2						3
10	2	1	2	3**	8	3	1			4	1				1	1
11						3				3						
Totals	110	57	43	5	215	393	42	33	8	476	98	7	1	1	100	7

* slipped

** checked

*** simple stamped

**** 3 brushed, 1 simple stamped

{ grog tempered, plain

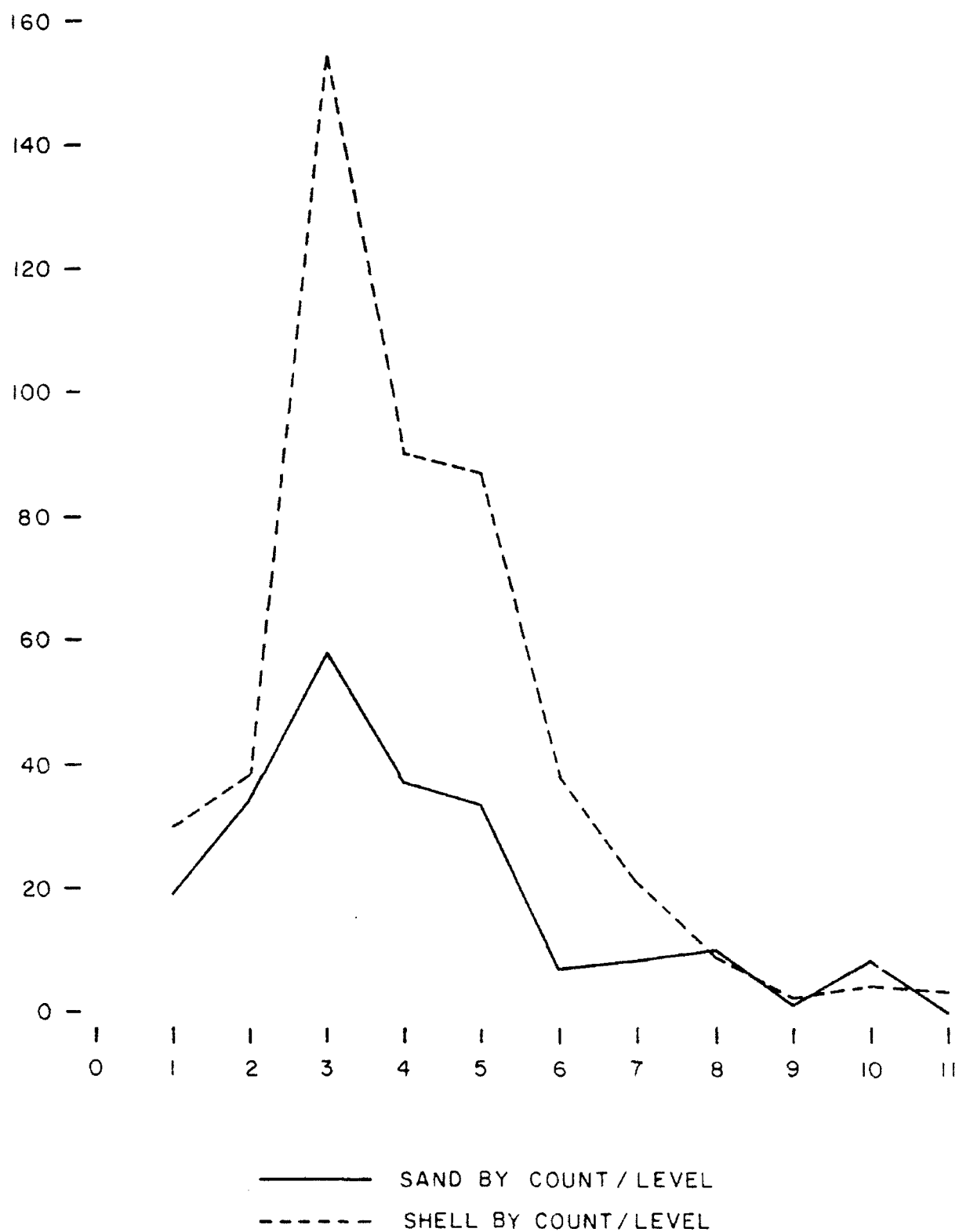


Figure 9-7. Depth distribution of ceramics at 3MS346. Vertical axis is number of sherds; horizontal axis represents various 10 cm levels.

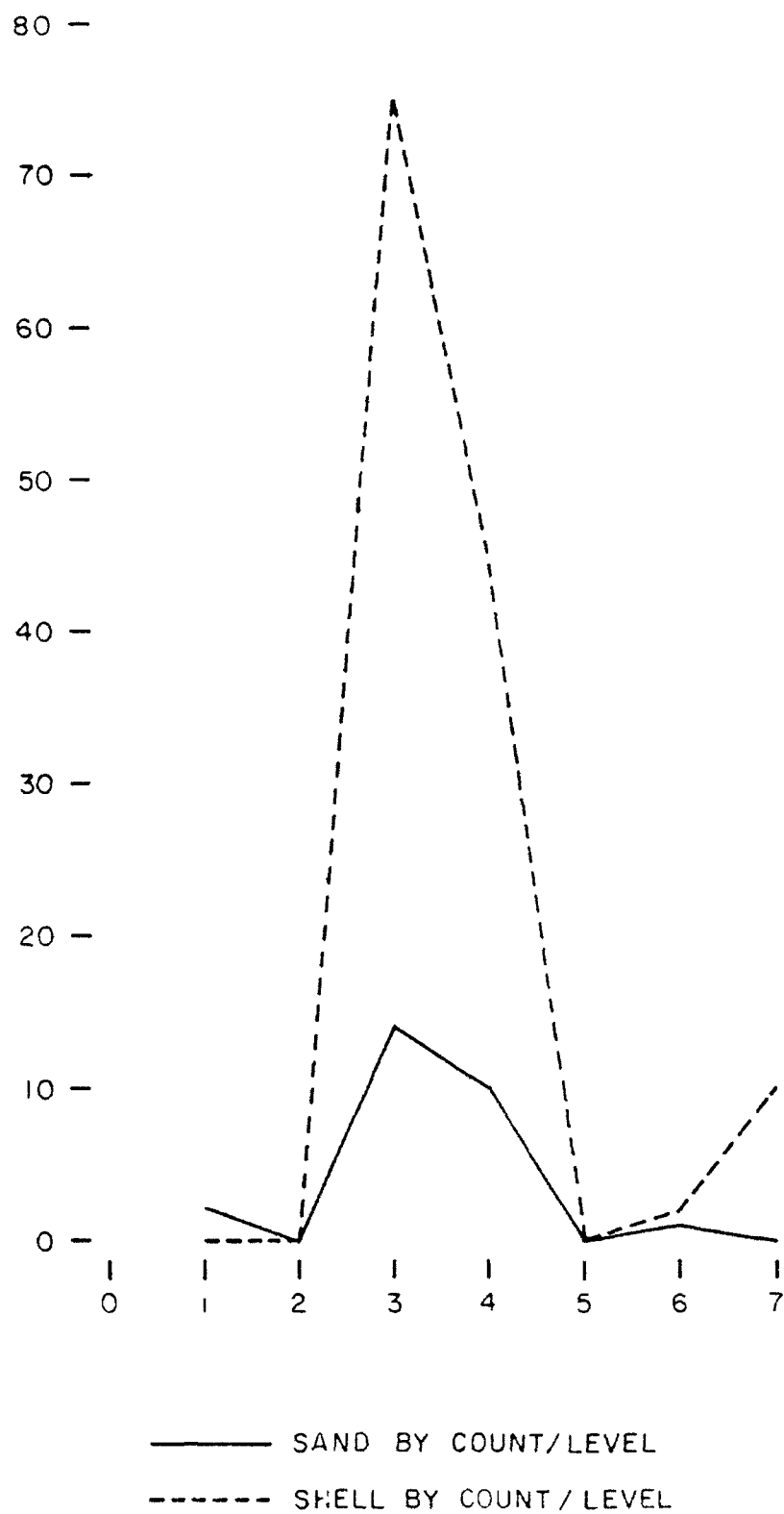


Figure 9-8. Depth distribution of ceramics at 3MS346, Block 1. Vertical axis is number of sherds; horizontal axis is 10 cm levels.

Late Woodland

The Late Woodland component is represented by Barnes Cord Marked, var. Barnes. The tempering agent is similar to that described for the Zebree site (3MS20). We took sand tempering to be the hallmark of the Late Woodland, and the presence of sand temper formed a primary classifying criterion as general paste characteristics were often difficult to identify in this badly weathered assemblage.

There is some evidence that the use of cord marking as a decorative technique increases through time in the Late Woodland in the northern Mississippi Valley (Morse 1977). Barnes ceramics developed around the latter part of the Middle Woodland, and at this time plain surface treatment predominates. Morse documents, however, that "by about A.D. 700 or slightly later, cord-marked pottery significantly outnumbers plain pottery" (Morse 1977:200).

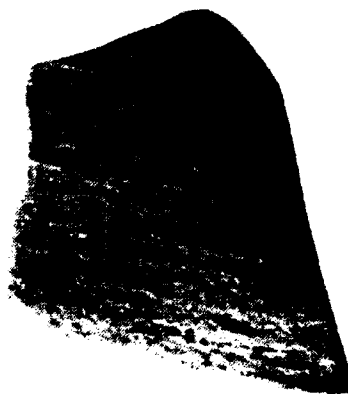
Of the total Late Woodland (sand tempered) ceramic count of 215, 27 percent (57) were cord marked (Table 9-3). Over stamping of cord marked surfaces was seen on many of the treated surfaces (Fig. 9-9b). This treatment is considered a normal part of the Barnes cord marked surface treatment (Million and Morse 1980). Four sherds are check stamped on a Barnes paste (Table 9-3, Fig. 9-9c). Except for one apparently slipped sherd, the remainder of the Late Woodland ceramic assemblage exhibited no discernable surface treatment. Six small, highly eroded rim sherds were counted (Table 9-4). A single grog tempered sherd, probably Baytown plain, var. unspecified, was recovered in the plow zone. This single grog tempered sherd, however, could possibly be part of the Early Mississippi component, and has been set aside in Table 9-3.

The Late Woodland ceramic data initially suggest a slightly earlier Barnes expression than that at Zebree because of the preponderance of plain sherds. However, this interpretation is of questionable validity. The entire ceramic assemblage is heavily weathered due to probable wind erosion and to water and air flow through the porous, sandy soils. Many of the surfaces classified as plain or unidentifiable might have once been cord marked. Many of the cord marked surfaces were themselves difficult to discern.

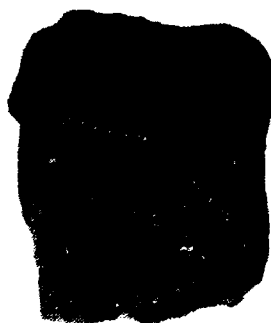
Early Mississippian

The Early Mississippian component is represented by shell tempered ceramics, Varney Red Filmed, var. Varney and Mississippi Plain, var. Neeley's Ferry. Of the total Mississippian ceramic count of 476, 9 percent (42) were red filmed, all on the interior surface. On a few specimens the slip was highly evident, but for most only traces of a slip still remained. No evidence for the manufacture of the slip was seen at the site.

Because of the eroded nature of the artifacts, it is difficult if not impossible to determine the number of vessels for the shell tempered ceramics. In fact, if the hypothesized breaking of a large Neeley's Ferry vessel (57.2 liters) into potentially more than 2500 sherds (Million and Morse 1980) is correct, that means that one jar has the capability to break into more than five times the total shell tempered ceramic assemblage on the entire site.



a



b



c

Figure 9-9. Late Woodland ceramics from 3MS346; a, cord marked; b, overstamped cord marked; c, check stamped. Maximum dimension of a is 67 mm.

TABLE 9-4. 3MS346, SAND TEMPERED RIMSHERDS, DESCRIPTIVE DATA

Location		Test Pit No.	Decoration				Shape		Thickness (in mm)	Weight (in grams)
North	South		Plain	Cord Marked	Unidentifiable	Flat	Rounded	Indeterminate		
18	30	21	x			x			5	4
65	20	51	x			x			5	2
70	29	61			x		x		7	1
85	26	54	x				x*		4	3
86	36	100	x				x		3	2
86	36	100			x			x	5	2
Totals			4	0	2	2	3	1	$\bar{x} = 4.8$	$\bar{x} = 2.3$

* this rim also notched

Twenty-three rimsherds were counted for shell tempered ceramics. Varney Red Filmed occurred in higher frequency in the rim sherd group than in the general shell tempered assemblage (Table 9-5). Flat and rounded rims appeared in about the same ratio. Three different vessel forms have been tentatively documented for the assemblage. All belong to the Varney Red Filmed ware group. Other vessel forms may be represented, however, because no determination of vessel form could be adequately made for the majority of the generally small and eroded rim sherds. Vessel forms were determined by degree of curvature exhibited by rim sherds large enough to be definitive, following the analysis by Million (Morse and Morse 1980: Chapter 18).

At least two jars are represented in the Varney Red Filmed ware. Both rims are strongly recurved and exhibit a weathered filmed interior (Fig. 9-10a, b). The exterior surfaces are not slipped. In both cases the lip is smoothed and rounded, with no visible surface treatment. The second vessel form documented for the site is a bowl (Fig. 9-10c). It is distinguished principally by a plain non-flaring rim similar to those documented for Zebree by Million and Morse (1980). The interior is red slipped to the exterior edge of the rounded lip. No other surface treatment is evident. The third vessel form documented on the site is a pan (Fig. 9-10d). The interior is red slipped, and dulled and weathered. The exterior is plain, but exhibits a small horizontal hairline crack possibly indicative of differential drying, or the method by which the vessel was molded. The lip is red filmed to the exterior surface and is 12 mm thick. Thickness of the sherd grades to 8 mm toward the body.

Mississippi Plain, var. Neeley's Ferry constitutes the remainder of the shell tempered ceramics (393 of 476). How much of this ware may have been red slipped (and therefore attributable to Varney ware) cannot be discerned. The ceramics are simply too eroded to make such calculations.

The shell temper ceramic data suggests an early Mississippian occupation, probably Big Lake phase peoples. This conclusion is based principally on the strong presence of Varney Red Filmed ceramics, and the lack of evidence for later Lawhorne phase (Mathews Incised, Manly Punctated) materials.

Lithic Analysis

A total of three small biface fragments were recovered from excavations at 3MS346. Two of the bifaces were located in the plow zone and composed of Crowley's Ridge chert. The third is a white chert of undetermined origin. The bifaces are not diagnostic. The lack of diagnostic lithic artifacts greatly hindered the association of the assemblage with the Late Woodland and Early Mississippian components at the site.

Table 9-3 above presents descriptive and distribution data for all other lithic artifacts recovered from 3MS346 (except one small chert flake recovered from Feature 6, a tree root mold). By far the predominant raw material was chert, with only minimal quantities of quartzite and orthoquartzite. Chert appeared to be Crowley's Ridge; no material could be identified as representing more distant, exotic chert quarries. Heat treatment was assessed by inspection for color changes toward reddish or purplish hues and for a vitreous, waxy appearance. Heat treatment appears to be only a minor factor in the assemblage.

TABLE 9-5. 3MS346, SHELL TEMPERED RIMSHERDS, DESCRIPTIVE DATA

North	South	Location Level	Test Pit No.	Decoration			Shape Rounded	Indeter- minate	Thickness (in mm)	Weight (in grams)
				Plain	Slipped	Uniden- tifiable				
65	34	3	Block 1	x				x	7	4
125	21	5	88	x					6	14
86	16	7	49	x					8	3
86	16	7	49	x					10	12
85	26	6	54	x					8	18
85	26	5	54	x					8	54
85	26	5	54	x					8	5
65	34	6	Block 1	x			x		6	8
85	26	7	54	x			x		7	2
85	26	5	54	x			x		9	1
85	26	3	54	x			x		7	2
85	26	5	54						8	8
85	26	5	54		x				8	15
71	35	9	5		x				8	17
66	39	4	48		x				5	1
65	34	3	Block 1		x		x		7	5
65	34	4	Block 1		x		x		1	2
65	34	3	Block 1		x		x		3	7
74	13	5	62		x		x		5	2
70	35	5	45		x		x		8	8
70	35	5	45		x		x		8	1
58	36	2	23		x		x		7	1
45	21	3	97			x	x		7	6
Totals				11	11	1	13	1	$\bar{x} = 6.9$	$\bar{x} = 5.2$

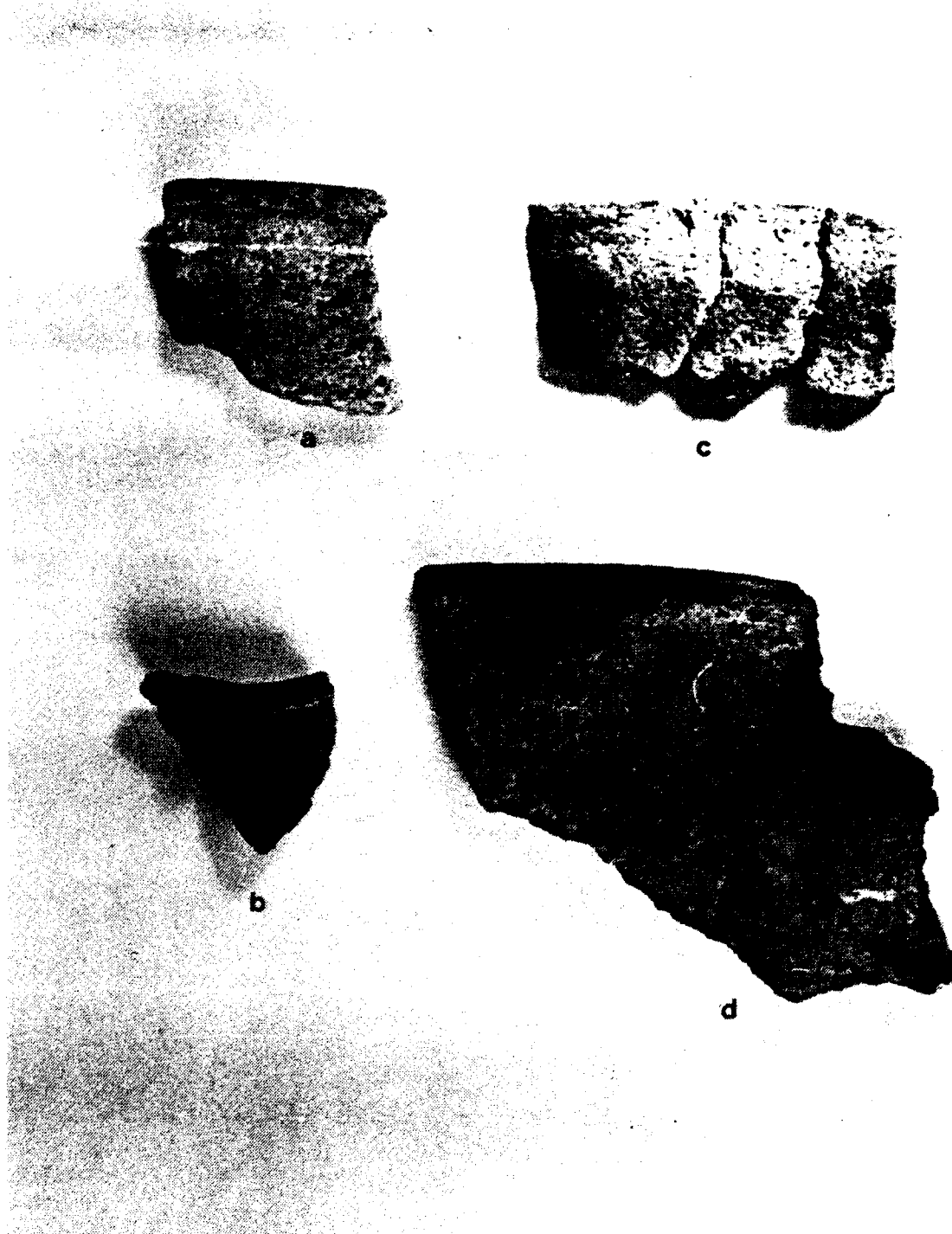


Figure 9-10. Varney Red Filmed ceramics from 3MS346; a-b, jar rims; c, bowl rim; d, pan rim. Maximum dimension of a is 61 mm.

Twenty-six of the 108 total flakes recovered showed enough evidence of cortex present to be classed as decortication flakes. Most of these flakes (22 of 26) had only small strips or patches of cortex, and were classed as secondary decortication flakes. Only four primary decortication flakes were identified. The remaining 82 lithic fragments were classified as interior flakes and shatter. In general, the flake assemblage was small and homogeneous. Most pieces seemed to be small shatter fragments or fragments of biface retouch flakes. The absence of cores and finished tools, and the lack of variety in the debitage assemblage indicate that little lithic manufacturing took place at 3MS346. Furthermore, it appears that lithic tools were highly curated. The flake assemblage appears to be what would be expected as a result of tool resharpening.

It is impossible to assign aspects of the lithic assemblage to the two components identified through ceramic analysis. Table 9-3 above indicates a simple depth distribution for lithics; this distribution appears highly correlated with both sand tempered (Late Woodland) and shell tempered (Early Mississippian) ceramic depth distributions.

Summary and Interpretations

The environment of site 3MS346 has been described generally in Chapters 5 and 6 above. To that description we might add here that, at 3MS346, a dune was apparently formed about 6,000 years ago by aeolian reworking of Late Pleistocene - Early Holocene braided stream bar deposits. As this dune became vegetated, it was stabilized until the clearing and agricultural development of this century. The dune area formed a slightly higher area, and was thus a possible site for human occupation.

Occupation by a small group, perhaps an extended family, began during the Late Woodland period, sometime between about A.D. 400 and 700. Based on the low ratio of cord making to plain sherds (Table 9-3, 9-4), we might guess that 3MS346 was occupied earlier in the Late Woodland than the nearby Zebree site (Morse and Morse 1980). The limited lithic assemblage at 3MS346 indicates minimal manufacturing of lithic tools and high curation of material and useful tools.

Little can be said about subsistence, activities performed, types of structures present, and seasonality of the site occupation during this period. Soil characteristics, including high acidity level and high porosity (air and water percolation), have probably acted to leach away soil stains indicating features and to destroy all bone and other organic remains. Further, mixing and deflation of deposits by wind action in the recent past since clearing and agricultural development were probably significant in destroying features and organic materials if once present.

The lack of data on subsistence, activities, structures, and seasonality makes it difficult to place this Dunklin phase Late Woodland occupation within a regional settlement - subsistence system. Morse (in Morse and Morse 1980: Chapter 17) has proposed a tentative settlement - subsistence pattern for the Dunklin phase (Barnes ceramics - using) people in the Big Lake region involving

primarily a series of widely dispersed small camps in summer and coalescence of at least some of these settlements into larger winter camps, based on seasonality estimates for the relatively large Barnes occupation at the Zebree site. Other sites in the region he sees as representing small nuclear/extended family homesteads or short term resource exploitation camps. Morse sees little solid evidence for use of domesticates by Barnes peoples, although this remains possible. Evidence from 3MS346 is scanty regarding these ideas. The site does appear to be small, and may represent a seasonal, family homestead. No evidence for or against use of domesticates is present. Based on the strong presence of ceramics, it is felt that an occupation of more significant duration and intensity than a resource exploitation station is represented.

If indeed the low percentage of cord marked ceramics in the Barnes assemblage indicates an early or middle Late Woodland occupation for that group, then there was probably a period of site abandonment before reoccupation in the Early Mississippi period about A.D. 700-1000. The site area had probably not changed very much, and was still a slightly elevated, heavily vegetated dune surrounded by lowlying swamp. The Early Mississippi, Big Lake phase occupants may have been interested in the site because of the presence of well drained soils capable of agriculture. Morse (in Morse and Morse 1980: Chapter 21) has proposed a settlement pattern for the Big Lake phase involving a major village (such as Zebree) surrounded by numerous dispersed farmsteads. It is plausible to postulate such a small farmstead as the Early Mississippi phase occupation at 3MS346, but positive evidence is lacking. No evidence of structures or storage pits was present, and the lithic assemblage (even assuming it was all Early Mississippi rather than Late Woodland) was extremely limited. No real activity areas or tool kits indicating activity performance could be identified.

Based on the amount of pottery present, however, the occupation would seem to represent more than a short term, resource exploitation camp. Soil conditions and recent wind erosion potential (discussed above) are such that features and structure evidence could have been destroyed. Given such impact to features, and hypothesizing a high lithic tool curation rate, a small family farmstead may be the best explanation for the cultural deposits present.

CHAPTER 10

TESTING AT SITE 3CG847 (TURKEY RUN SCHOOL SITE)

Introduction

Site 3CG847 is located in eastern Craighead County about 5.2 km west of the junction of the Honey Cypress and Buffalo Creek drainages. Located on two buried sand dunes, site elevation is approximately 71.7 meters above mean sea level. The site lies in an open field (channel plug) and is bounded east and west by excavated portions of the diversion canal. To the south, site 3CG847 terminates in a cultivated field. To the north, the prehistoric component terminates before reaching the county road. Recent historic materials, however, cross the road into the adjacent cultivated field for about 30 meters. The prehistoric component of the site is restricted primarily to two dune areas in the channel plug (Figs. 10-1, 10-2).

Unlike site 3MS346, 3CG847 had several historic structures located on the site. The historic area is restricted to a narrow corridor on both sides of the county road. The area north of this road has been occupied since the 1930s, and possibly earlier. No structures dating to this early twentieth century period were located south of the road, although a 1932 USGS map indicates a former structure whose location may be under the present western spoil pile on the north side of the drainage canal. This same map also shows the nearby former Turkey Run School located off the site to the northeast.

This area of eastern Craighead County remained sparsely populated until the 1950s. At this time, houses were common along both sides of the road both east and west of the site, as well as along the site area itself. During this recent historic period, possibly as many as three structures (houses) were located south of the county road. These structures are documented by the 1956 Leachville USGS quadrangle map and by local informants who indicated that the last of the houses was torn down only a few years ago. This information was substantiated in the field by a dense concentration of recent historic artifacts paralleling the county road. No large barns or other out buildings were documented for site 3CG847, although a modern county trash dumpster was reported to have stood in the northwest corner of the site in the 1950s.

Soil Morphology

Pedologic analysis of the site shows the site to be similar to site 3MS346. The principal difference is that there are two dunes in the channel plug area rather than one. Like site 3MS346, both dunes were occupied by Late Woodland and probably Early Mississippian peoples. The dune sands are virtually identical to those of site 3MS346, being composed of well drained sandy loam sediments (Fig. 10-1, Table 10-1). Lamella development is pronounced in both dune areas. Earthquake sands cover much of the western quarter of the channel plug area and in pockets in the northern part of the plug (Fig. 10-1). In the northwestern quadrant of the channel plug area, depths of one meter or more of earthquake sands cover the original surface. The remaining soils over the plug consist of poorly drained sandy loam sediments (Fig. 10-1, Table 10-1).

The dunes at this site, like 3MS346, appear to fit the pattern of aeolian formation put forward by Saucier (1978). The site is flanked by relict braided channels to the west and east, providing an optimum opportunity for dune formation (Fig. 9-4 above). A date of similar antiquity to the channel dated

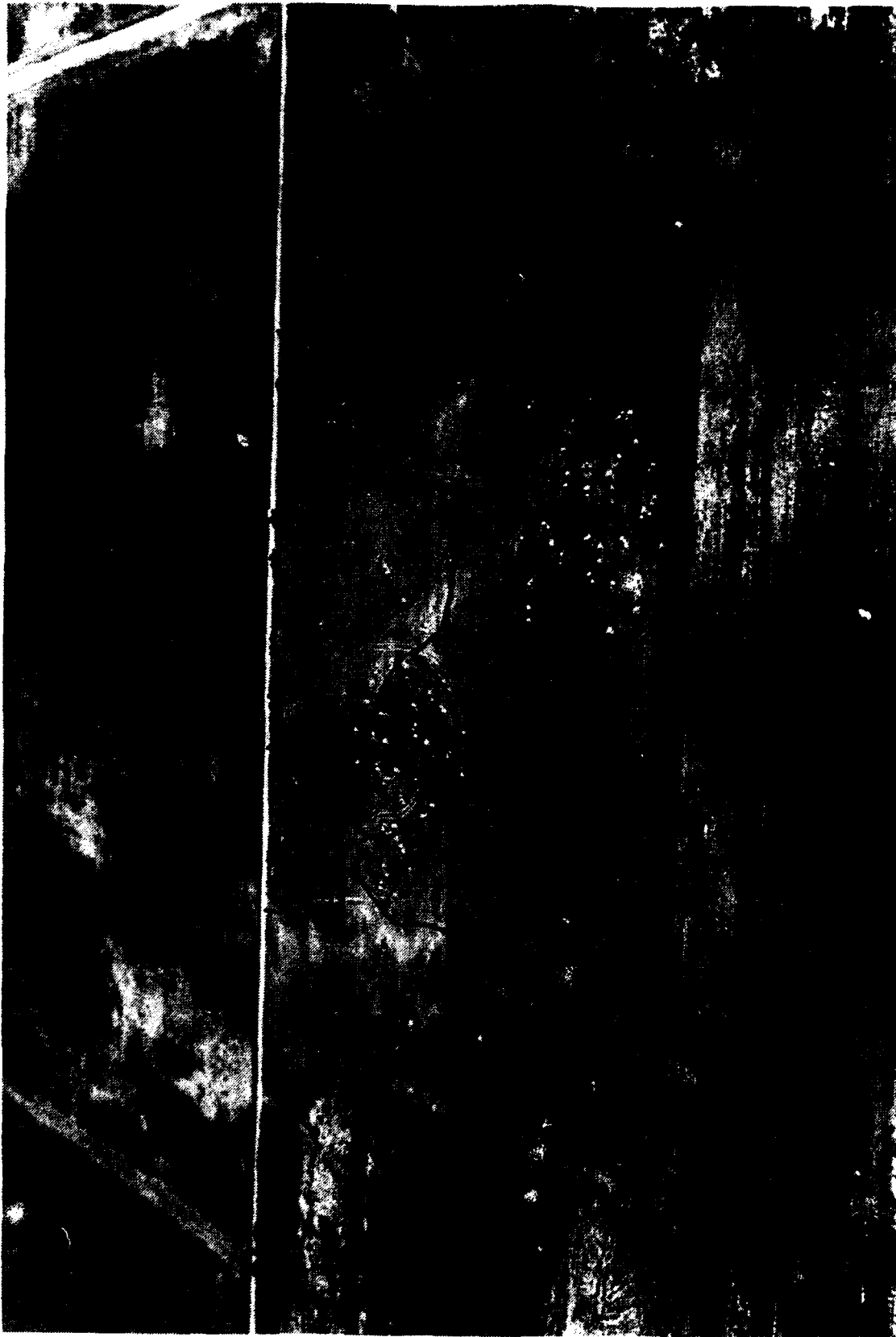
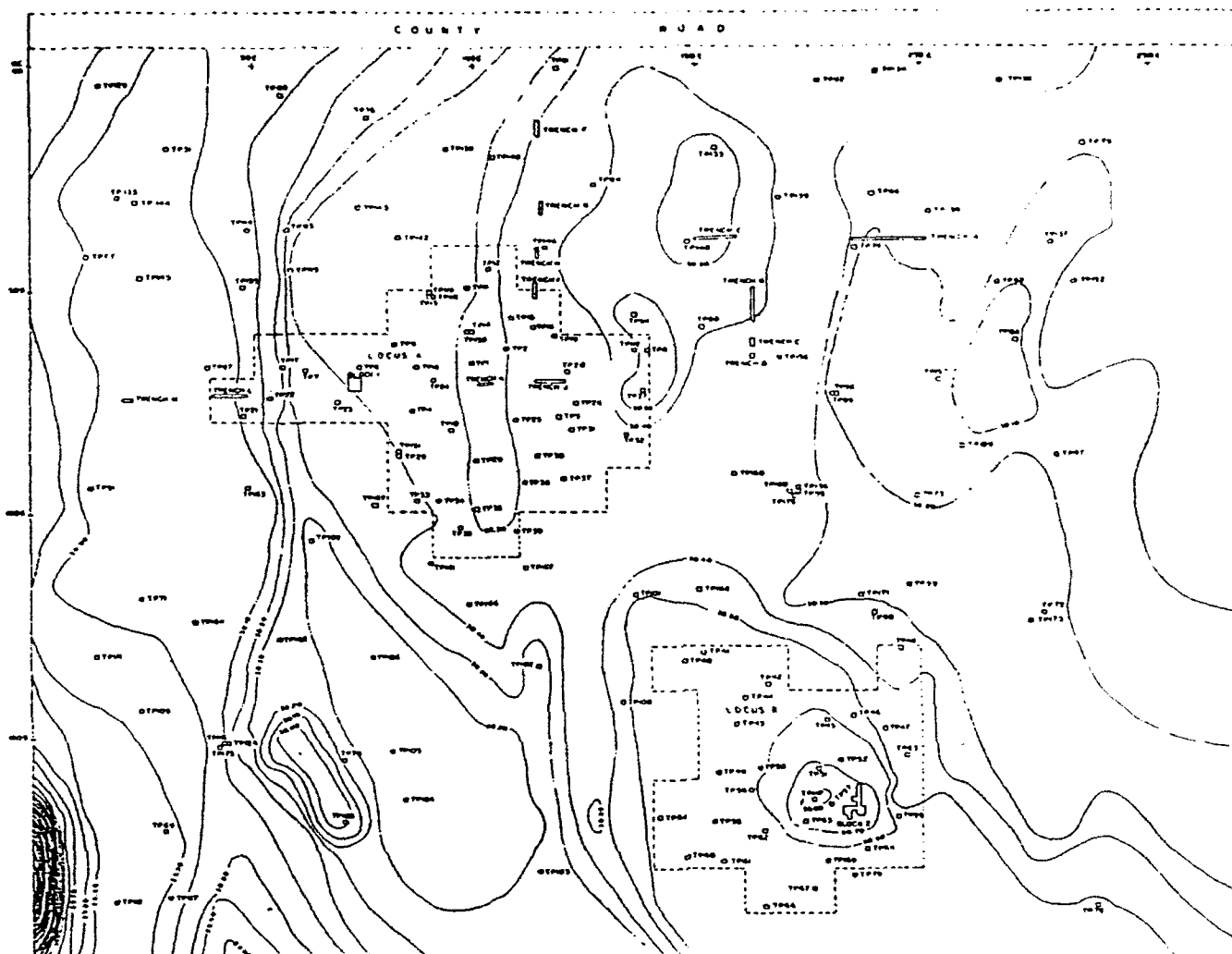


Figure 10-1. Oblique air view to the north of site 3CG847, with soil groups keyed to Table 10-1 shown superimposed.

TABLE 10-1. SOIL MAPPING UNITS AT SITE 3CG847

<u>No.</u>	<u>Description</u>
1.	Area influenced by earthquake activity with 20-100+ cm of sand covering the original surface. Somewhat poorly drained.
2.	Probable area of wind-sorted fine sandy loam sediments, moderately well drained to well drained.
3.	Sandy loam sediments with a thin mantle of earthquake sands on the surface, 0-30 cm. Somewhat poorly to poorly drained.



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CRANEHEAD CO., ARKANSAS



Figure 10-2. Contour map of site 3CG847. Contour interval is 10 cm. Locations of test pits and backhoe trenches are shown. Areas within dashed lines, Locus A and Locus B, are high surface artifact density areas.

at site 3MS351 is suspected for the relict channels adjacent to site 3CG847, based in part on the projected age of these channels by Saucier (1964). Lamella development (Fig. 10-3) similar to that at 3MS346 also suggests dune development approximately 6000 to 7000 years ago.

Post-Depositional Impacts

The site has been under intensive cultivation since the early 1900s. Plowing has resulted in a 15 to 30 cm deep plow zone over the entire site. Because sites 3MS346 and 3CG847 are geologically similar, the effects of post-depositional processes are similar. Local informants indicated that much of the topsoil at 3CG847 had been lost to erosion. This erosion probably had the result of shifting the dune areas back and forth and mixing and deflating the cultural deposits.

The effects of the New Madrid earthquake may have been somewhat more pronounced at this site than at sites 3MS346 or 3MS351. Numerous sand blows were located beneath recent historic materials. In fact, most of the western and northern part of the canal plug area at 3CG847 was flooded and buried by earthquake sands up to 1.5 meters deep (Figs. 10-1, 10-4).

Chemical analyses of dune sands indicated a low pH value, probably resulting from heavy fertilization of the site area. This high acidity and the generally porous dune sands allowing air and water flow, probably resulted in the destruction of organic remains and the leaching away of soil stains.

Testing Program

Site 3CG847 was intensively surface collected (100%) in gridded ten-by-ten meter units. Artifact densities were plotted revealing two distinct prehistoric concentrations, and a third historic concentration (Figs. 10-2, 10-5, 10-6, 10-7).

Figure 10-5 represents the distribution of sand tempered ceramics by count, and figure 10-6 represents the distribution of residual (less than 1/2 inch) sand tempered sherds by weight. Two separate clusters (Locus A, Locus B) become apparent when the weight of residual sand tempered sherds is considered. Larger, non-residual, sherds are more dense in Locus A, so much more dense that Locus B did not even appear in Figure 10-5. This higher density is also indicated for Locus A in the residual sherd weight map of Figure 10-6.

The low ceramic density areas distributed between the two loci are thought to be redeposited from the adjacent higher dune areas. Virtually no shell tempered ceramics were discovered, nor were there enough lithic artifacts to map at even a minimum one count interval. Attempts to map these low density classes produced non-interpretable maps with contours based on chance occurrences of one or two artifacts.

Figure 10-7 shows the surface distribution of recent historic material. The distribution reflects 1950-1960 debris, mostly metal and brick or cement chunks. Three probable house areas are documented by clusters of historic debris. Each area was visible on the ground as a low rise covered by a different vegetation (after weeds grew up following site disking) than surrounding areas paralleling the road. Because the materials were obviously recent, little effort was expended in these house sites. Since no random one-by-one meter units fell in the house mound areas, a single shovel test of

74E+72S

74E+73S

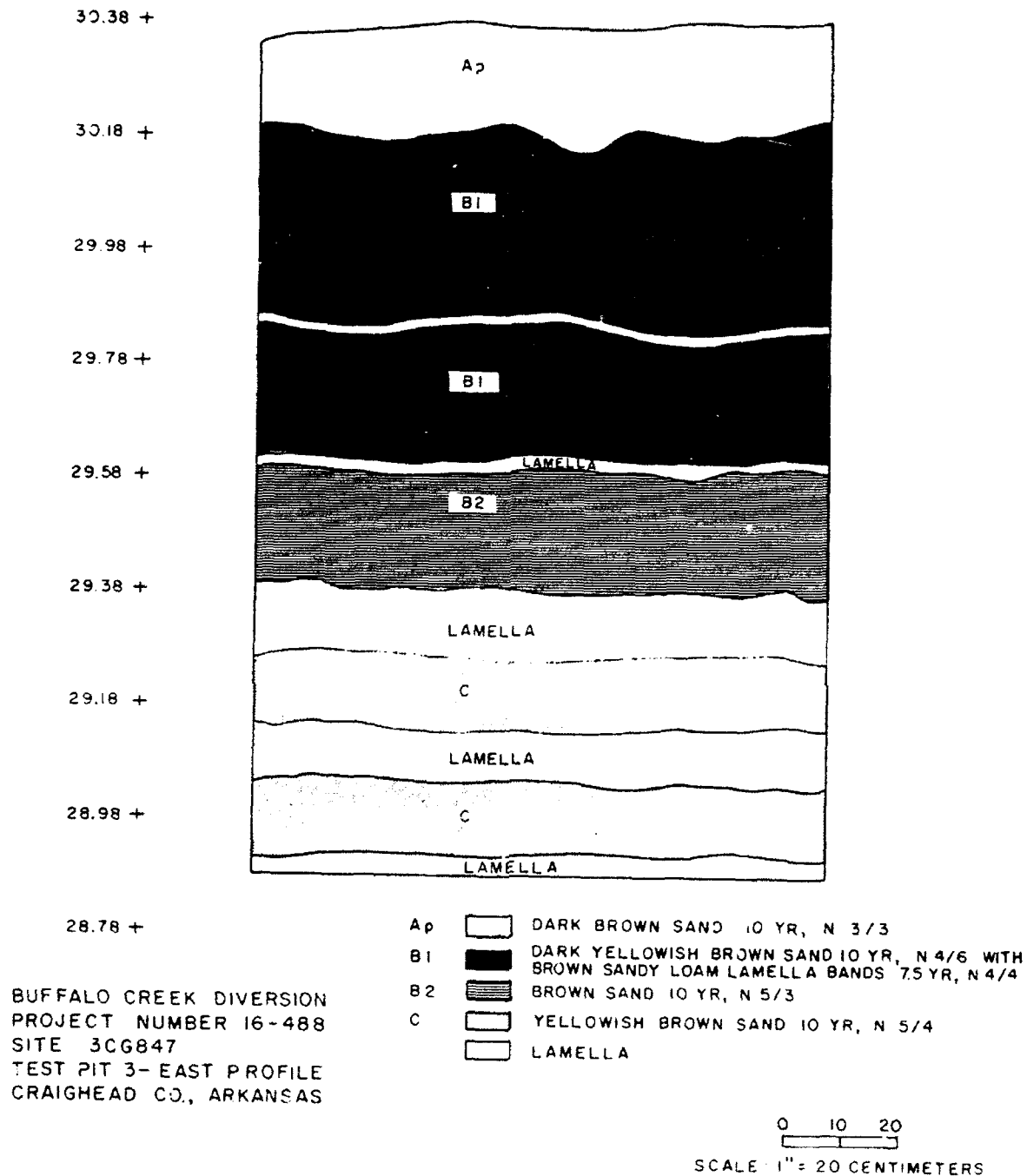


Figure 10-3. Test pit 3, east profile, site 3CG847.



Figure 10-4. Profile of Backhoe Trench L, showing covering of extruded sand.

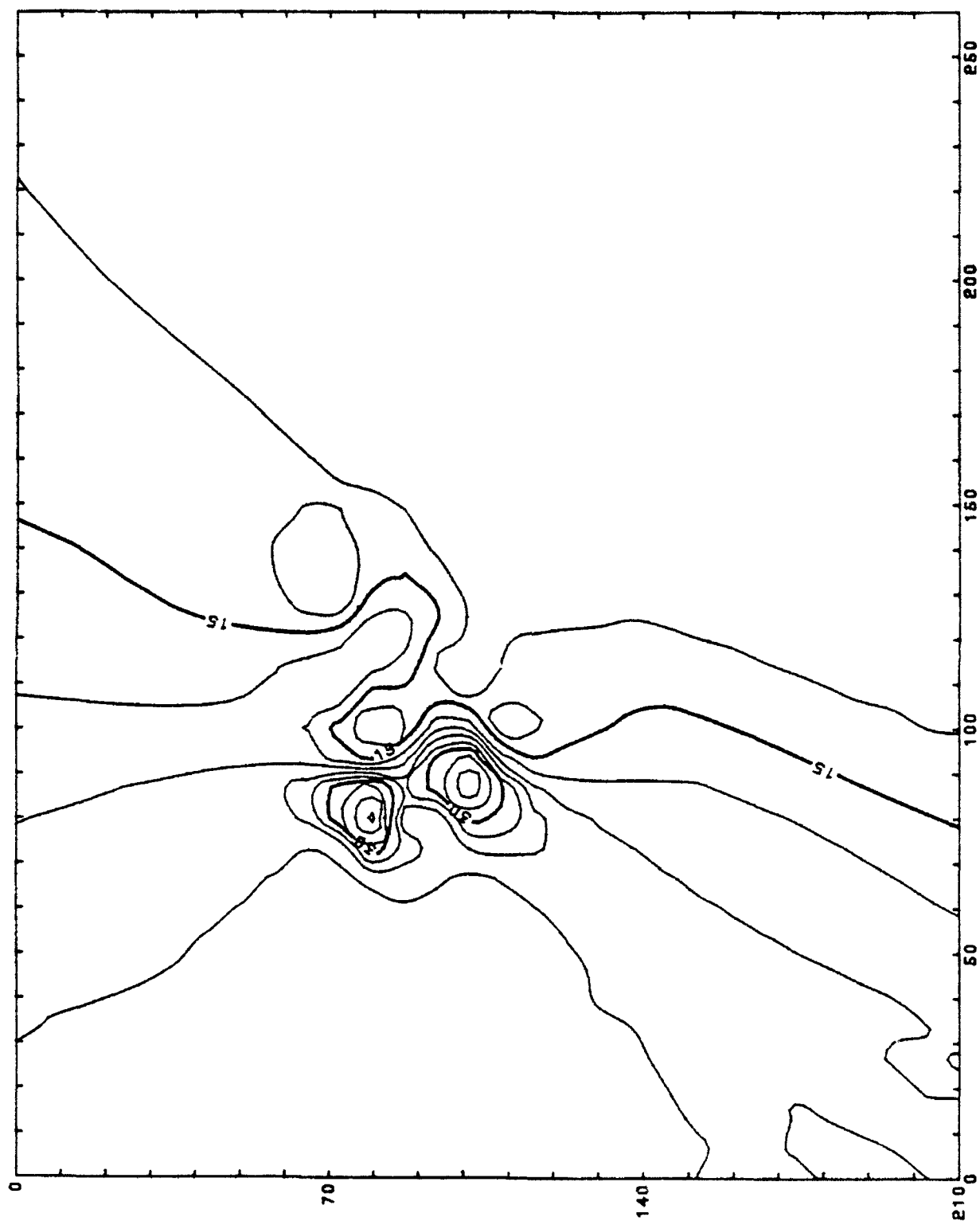


Figure 10-5. Distribution of round and tempered sherds by count at 3CG847 on site surface. Data contoured are number of sherds per 10 m square.

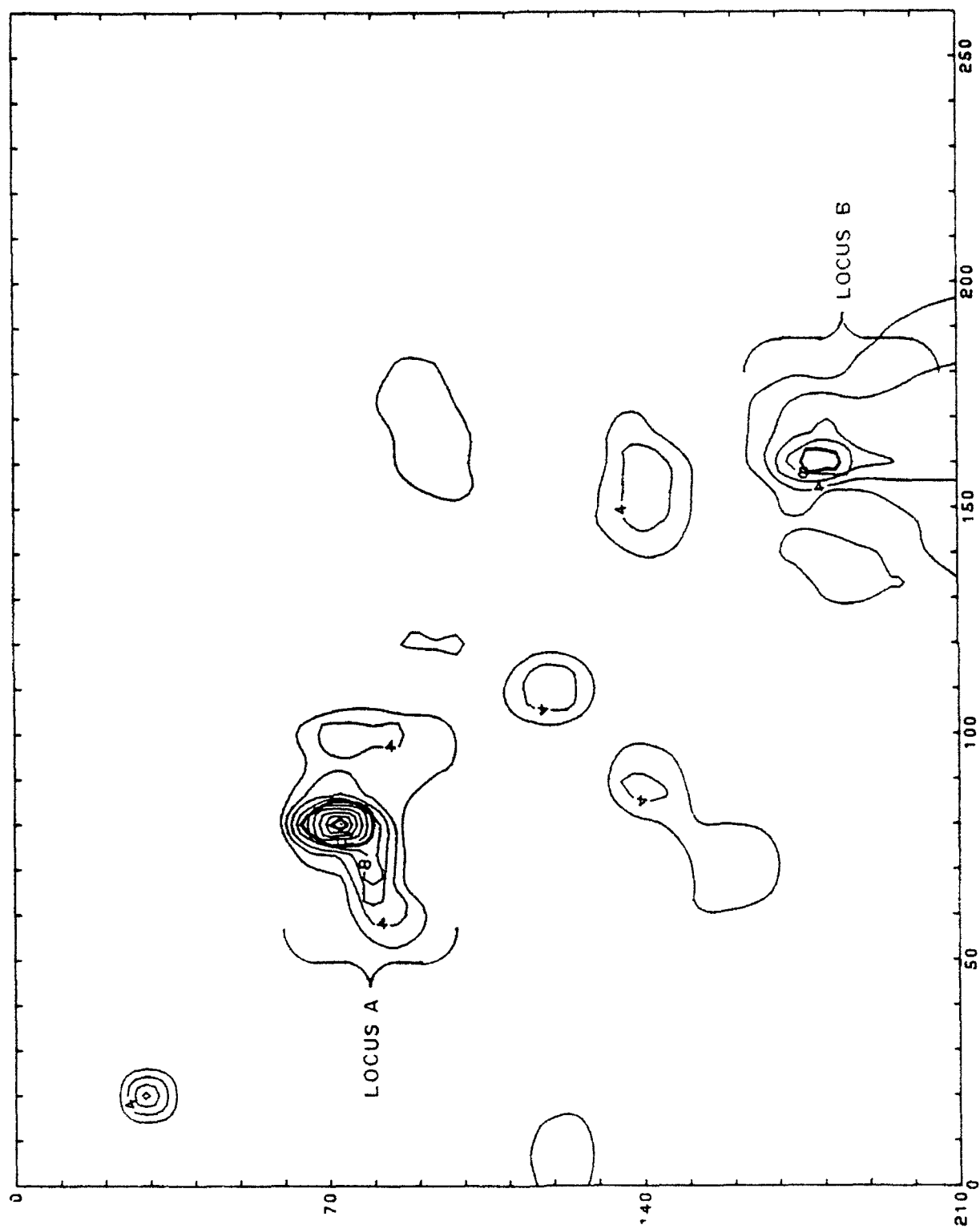


Figure 10-6. Weight (grams) of weathered (residual) sherds per 10 m square from the surface of 3CG847.

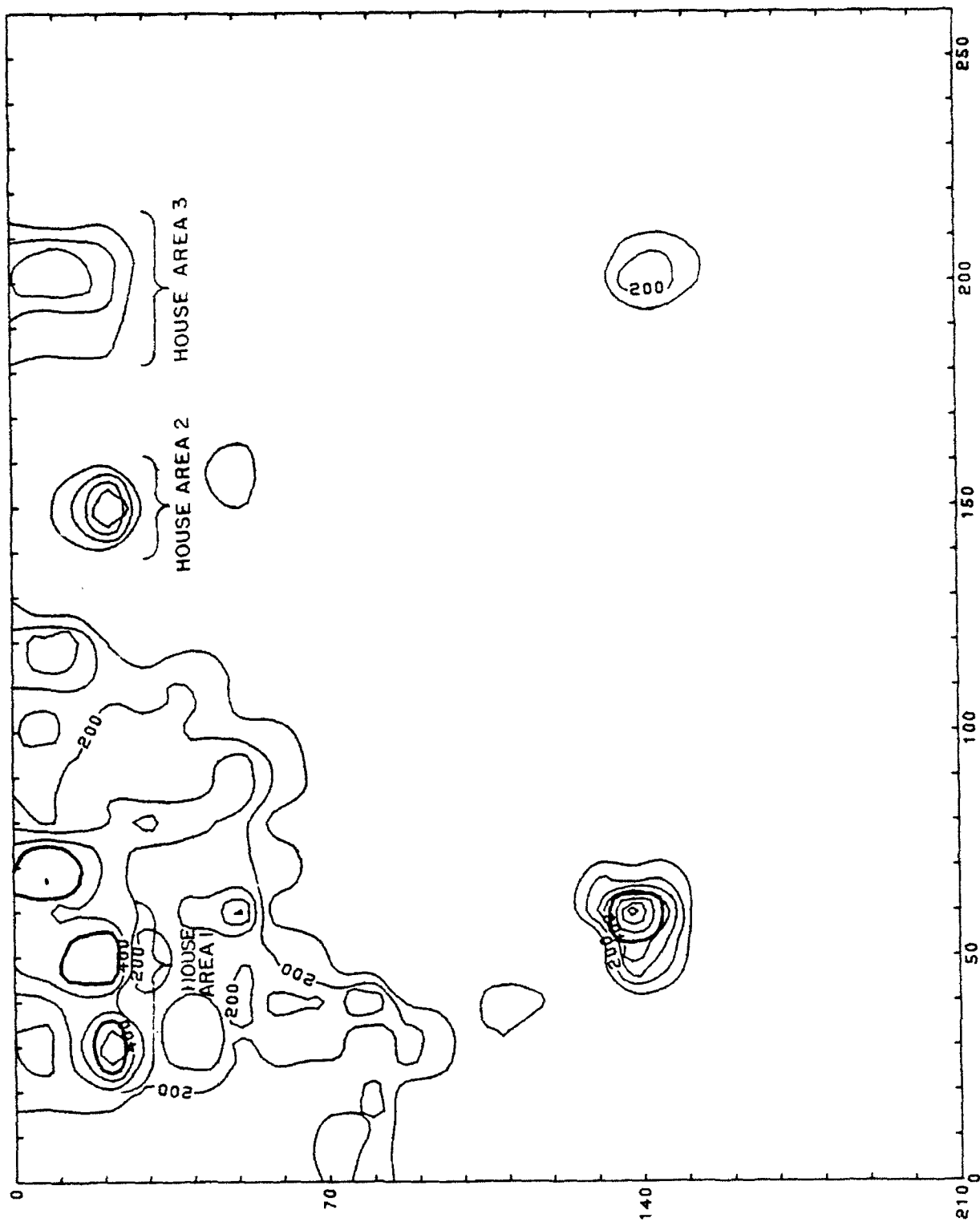


Figure 10-7. Weight (in grams) of historic material by 10 m square on the surface of site 3CG847. Historically known house areas superimposed.

each area was excavated to the level of the earthquake deposits. This was done simply to check for earlier materials. None were found.

The wide distribution of historic artifacts in the northwest quadrant of the site is probably the result of the dumpsite which stood in this area, along with scattered house remains. The two areas located in the southern part of the channel plug are simply chunks of iron from broken farm implements. Their high weight values cause them to be well represented on the map.

This site was thought to be the largest in surface area by the previous survey, and the entire channel plug area had been indicated as site area. Our surface collections, while strongly indicating the two major loci, also showed a few artifacts from all parts of the channel plug area. We decided to sample the entire area at a minimal level to test for buried materials and to compare subsurface results to those of the surface collection. Sampling at a .05 percent level, test units were dispersed in such a way that all regions of the canal plug were investigated. The initial test units were placed by randomly selecting a one meter square from a series of 10 by 20 m blocks laid out over the canal plug area. The areas of prehistoric surface artifact density (Loci A and B) were additionally tested (by additional random selection) to insure a minimum 1.0 percent sampling level of these areas. Additional, subsurface density areas located in the testing of the canal plug area were planned to be sampled in the same manner. None were found. The distribution of these test units is shown in Figure 10-2. For the entire site a total of 175 one-by-one meter units were excavated. Units were excavated to 70 cm below surface or to sterile deposits below 70 cm. Thirteen sediment profiles were also excavated by backhoe in areas of low artifact density.

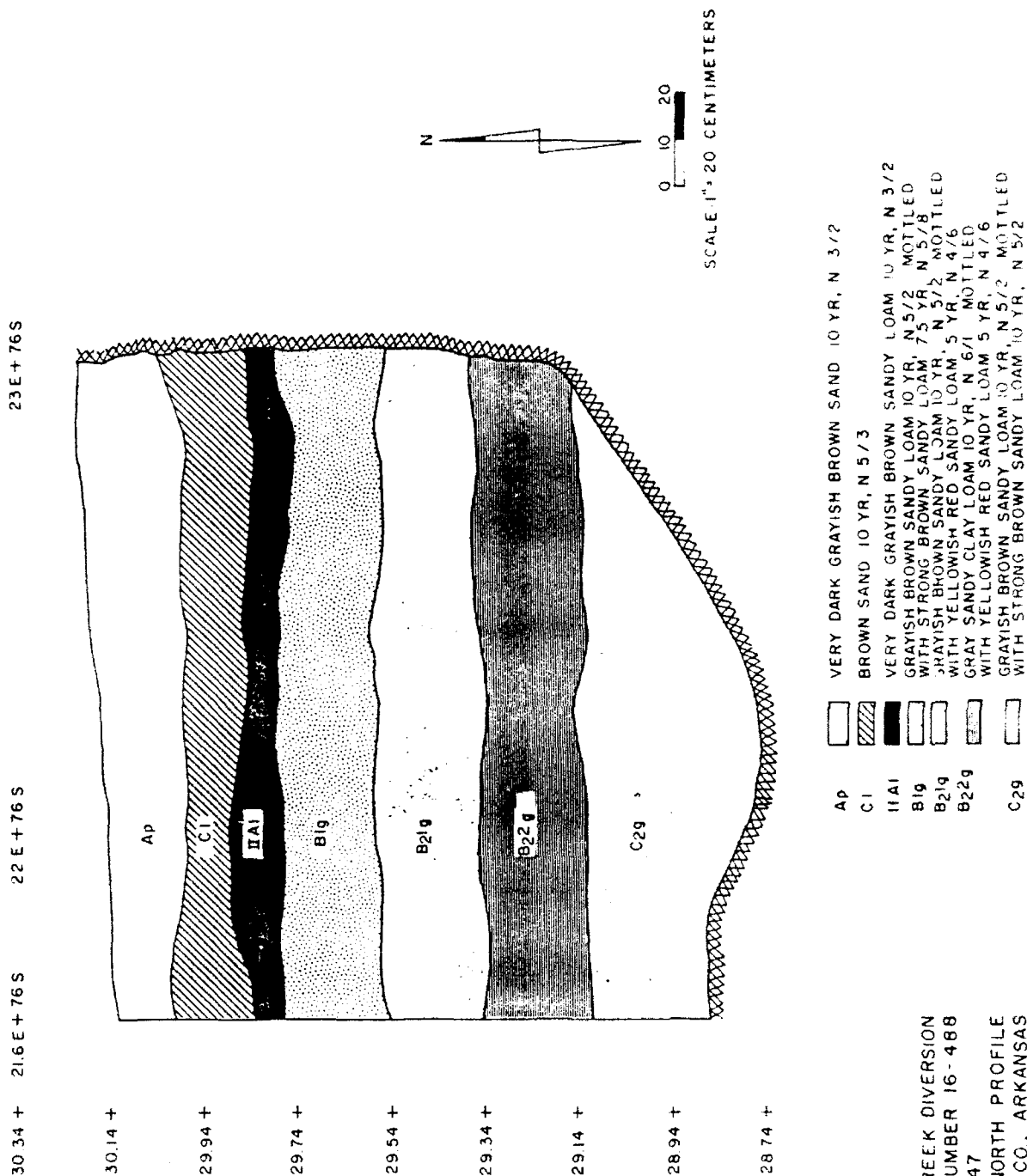
Test pits placed outside the dune areas were relatively unproductive. Test pit profiles were generally similar, except where overlying earthquake sands were encountered. Pedologically, the non-dune soils were moderately to poorly drained sandy loams with no lamella development. Testing beneath the extruded earthquake sand deposits revealed virtually no cultural material. No prehistoric cultural features were discovered in any of the units outside the dune areas. Four recent historic features were located in the historic area of the site paralleling the county road (Table 10-2).

Test pits placed on the dune areas (Fig. 10-2, areas inside dashed lines) revealed a redeposited sample of Late Woodland (Barnes) ceramics. Stratigraphically and pedologically, the soils in all test pits placed in both loci were similar to one another. Unlike the poorly drained off-dune soils, the dune soils were composed of wind sorted fine sandy loam with well developed lamella (Fig. 10-3). No prehistoric features were located in either dune area.

Thirteen sediment profiles were excavated by backhoe. All were placed outside the dune areas of the site. Backhoe Trench M (Fig. 10-8) exemplifies the general pedological development of the soils found off the dune areas, with the exception of the extruded sands from the earthquake which were previously discussed and mapped (Fig. 10-1). From the surface of the exposed face modern Ap soils overlie earthquake (C1) deposits resulting from the 1811/1812 New Madrid earthquake. The earthquake deposits are shallow in Trench M, but become considerably deeper (a meter plus) in a large crevasse or L-shaped blow hole mapped in Figure 10-1 (soil unit 1). The following sediments are composed of a buried IIA horizon, followed by a series of developing B horizons. The C horizon was the last major pedologic soil horizon identified in Trench M. As

TABLE 10-2. FEATURES AT SITE 3CG847

Feature Number	Horizontal	Vertical	Feature Type	Time Period	Artifacts	Diagnostic
1	46S/102E	29.66-29.58	Trash Pit	Recent Historic	Cans	Absent
2	52S/89E	29.92-29.75	Post	Recent Historic	Absent	Absent
3	167S/184E	30.50-30.18	Tree	Recent Historic	Absent	Absent
4	41S/185E	30.07-29.78	Post	Recent Historic	Round Nail	Absent
5	74S/180E	29.88-29.84	Tree	Recent Historic	Absent	Absent
6	74S/180E	29.90-29.83	Tree	Recent Historic	Absent	Absent
7	167S/185E	30.40-30.30	Tree	Recent Historic	Absent	Absent
8	168S/182E	30.65-30.20	Post and Tree	Recent Historic	Belt Buckle	Absent
9	167S/182E	30.61-30.21	Tree	Recent Historic	Absent	Absent
10	52S/90E	30.02-29.46	Post	Recent Historic	Metal	Absent
11	52S/90E	29.98-29.85	Tree	Recent Historic	Absent	Absent



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TRENCH M-NORTH PROFILE
CRAIGHEAD CO., ARKANSAS

Figure 10-8. North profile of Backhoe Trench M at site 3CG847.

previously stated, the off-dune pedologic development exposed in Trench M is similar across the site. The principal variation in this pattern reflected occasional flooding of lower elevations of the channel plug. This was evidenced principally by a blue-grey color which is not usually seen on moderately to well drained soils. Soil textures and compositions were not significantly altered. No signs of prehistoric cultural activity were seen in any of the backhoe trenches.

During the latter stages of testing two small block excavations were opened (Fig. 10-2). One block was located in each of the dune areas (Loci A and B). Block Two, located in Locus 2, was excavated because of what was initially thought to be a possible wall trench structure discovered in two adjacent one-by-one meter test units. Expansion of these units developed no evidence of a structure; rather, the feature was determined to be an uprooted tree approximately two feet (0.9 m) in diameter at the trunk. A similar occurrence is documented for site 3MS351, discussed in Volume II. No prehistoric features were located in the block. A recent historic feature (Table 10-2) was found adjacent to the tree trunk fill.

Because of the tree, wind deflation and historic intrusions, Locus B was found to be heavily disturbed. No midden was encountered. Ceramic artifacts occurred vertically to a depth no greater than about 60 cm below surface. The artifacts were eroded, and frequently found "edge-on", indicating deflation and possibly freeze-thaw pedoturbation.

Block One, located in Locus A, was excavated because the small amount of ceramics from the site were clustered in Loci A, and because the ceramic count in Test Pit 3 nearby appeared to vertically cluster at about 80-100 cm below surface, indicating the possibility of an intact living floor. The reason for this apparent clustering became apparent with the excavation of Block 1. The visible clustering of artifacts was created by the thick, relatively impermeable lamella lens which impeded the vertical displacement of the artifacts (Fig. 10-3). Virtually no artifacts were recovered from the lamella lens or beneath it. Similar to site 3MS346 and Locus B, the artifacts were frequently lying at an angle suggesting vertical and/or horizontal displacement. No prehistoric features were located in Locus A.

Four soil samples were processed for pollen, three from Test Pit 3 in Locus A and one from Test Pit 9A in Locus B. A combination of heavy-liquid flotation and centrifugation was used to separate the pollen from the soil matrix. Five glycerin jelly identification slides were made from each sample and searched for pollen. Only five Ambrosia (ragweed) and one Amaranthus-Chenopodium pollen grains were found in Test Pit 3, clearly an insignificant amount. These are probably intrusive. No pollen was found in the sample taken from Test Pit 9A. Pollen analysis procedures are presented more fully in Appendix A.

Flotation samples were taken from all features and were also taken from test units on a selective basis. Samples were taken from arbitrary 10 cm levels from about 20 percent of the total test excavation units (35 units). None of the floated samples contained any prehistoric material. Historic materials recovered were recent and post-dated 1950.

Magnetometer Survey

A portion of Locus B was subjected to remote sensing after surface collecting but before excavation in an attempt to locate activity areas such as storage pits, hearths, house floors or trenches, or midden deposit. The technique has been used successfully at other sites to determine depth and location of buried features (Weymouth and Nickel 1977; Kaczor and Weymouth 1980; Castille, Glander and Gagliano 1982). The remote sensing techniques utilized in the field are presented in Chapter 8 of this volume.

The magnetic survey of Locus B was conducted to determine the feasibility of utilizing magnetic survey techniques on low density sites. A 20-by-20 meter grid was laid out in the area of Locus B, and a one-meter grid interval was established. Readings were taken at each grid intersection at a sensitivity interval of 1/4 gamma. Upon completion of the survey all of the data was smoothed according to the principles developed by Breiner (1973) and Nettleton (1976), and a hand drawn contour map was made. Upon completion of the fieldwork all data were punched on cards for production of magnetic map printouts using a Surface II program developed at the University of Kansas (Sampson 1978).

Two subsurface anomalies were isolated in the magnetic survey (Fig. 10-9). Anomaly 1 was tested with the excavation of a one-by-one meter test unit (T.P. 56). This unit revealed the anomaly to be of recent historic origin: a large chunk of iron was located in the lower plow zone (about 30 cm B.S.). No prehistoric materials or features were located in the excavation unit. Anomaly 2 was more subtle than Anomaly 1. The second anomaly was tested with the excavation of a one-by-one meter unit (T.P. 169). The anomaly is thought to be derived from a small sand blow or fissure on the southern edge of the sand dune. In this area the dune soils are interrupted by C horizon earthquake sands. The soil sequence consists of the modern Ap horizon, followed by 10 cm deep earthquake sands. The following soils consisted of a poorly drained sandy loam similar to soils of the non-dune areas of the site. No signs of cultural activity were found in the excavation unit.

Ceramics

The major component represented at the site is Late Woodland, although a small Early Mississippi occupation is indicated by 91 sherds dating to that period. The total non-residual subsurface ceramic count is, like 3MS346, small; 798 sherds were recovered from our surface collections and excavations. The distribution of these sherds by levels at the site is presented in Table 10-3.

Figures 10-10, 10-11, 10-12, 10-13 represent the subsurface distribution of ceramic counts for the site for Levels 3-6. Because of the low number of sherds, all contour intervals had to be kept to a minimum in order to plot the data. For these figures the contour interval is two. These figures graphically display the occupation of both dune areas, with the heaviest concentration on Locus A. Smaller numbers of ceramics noted between the principal dunes were probably redeposited artifacts in lower areas of the site. Evidence for occupation of Locus B ceased after Level 6. As previously stated, ceramic artifacts were documented up to a meter (Level 10) in Locus A; however, the artifacts were displaced vertically and tended to accumulate at a clay lamella lens (Fig. 10-3). The proximity to an L-shaped crevasse (Fig. 10-3) is probably the reason the artifacts are more deeply buried than those in Locus B.

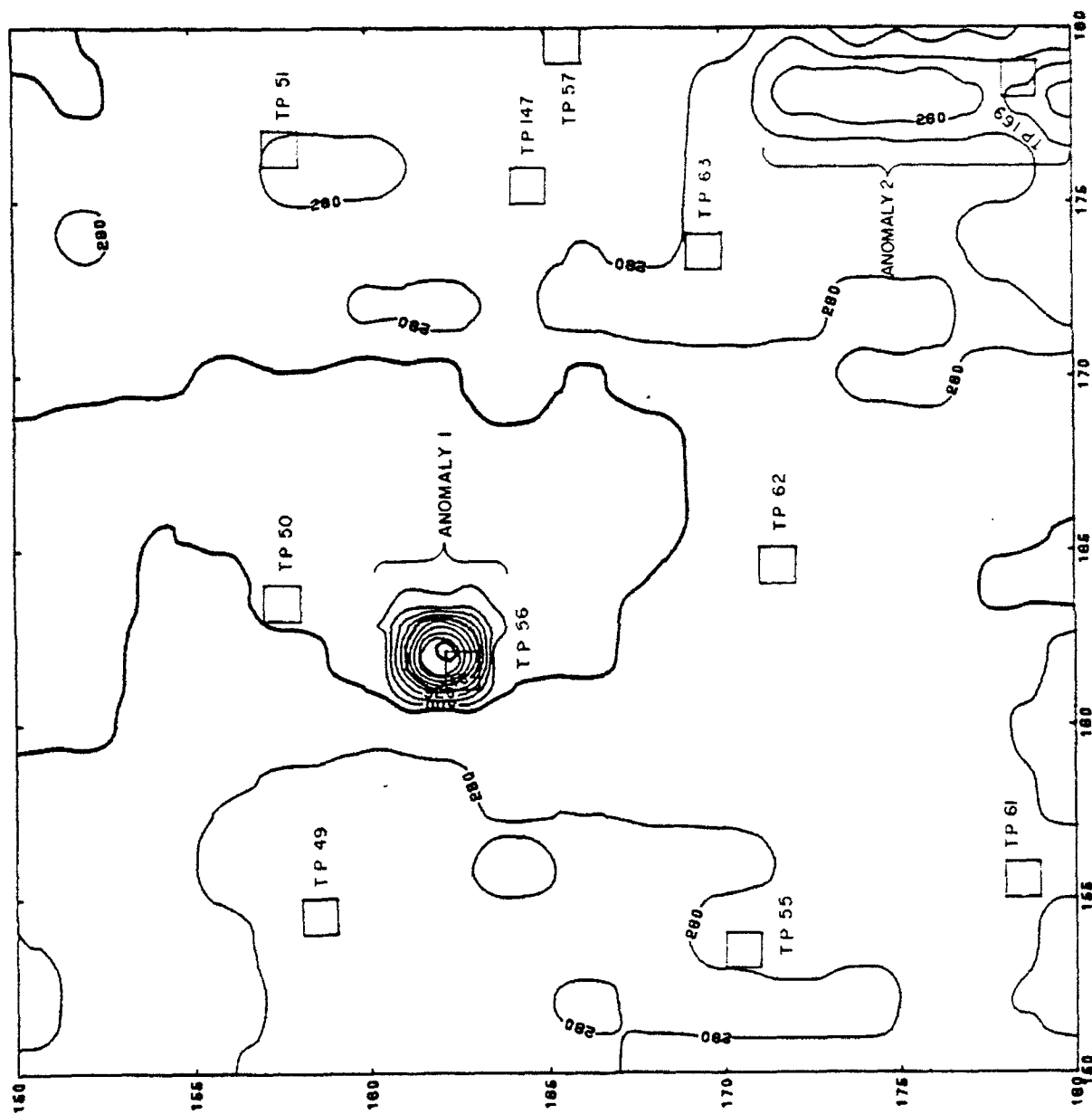


Figure 10-9. Magnetometer map of area in southeast portion of site 3CG847. Readings made at $\frac{1}{4}$ gamma.

TABLE 10-3. DISTRIBUTION OF CERAMICS, 3CG847

Level	Sand Temp. Plain	Sand Temp. Cord	Sand Temp. Unid.	Shell Temp. Plain	Simple Stamp	Filmed	Total
Surface	11	21	26	8		2	68
1	9	18	13			2	42
2	7	48	17	2		19	93
3	28	62	72	1		16	179
4	11	66	51			8	136
5	19	46	46			19	130
6	7	24	27	6		4	68
7		10	8	1	1		20
8	2	3	2				7
9	7	4	2			2	15
10	2	19	18				39
11		1					1
Totals	103	322	282	18	1	72	798

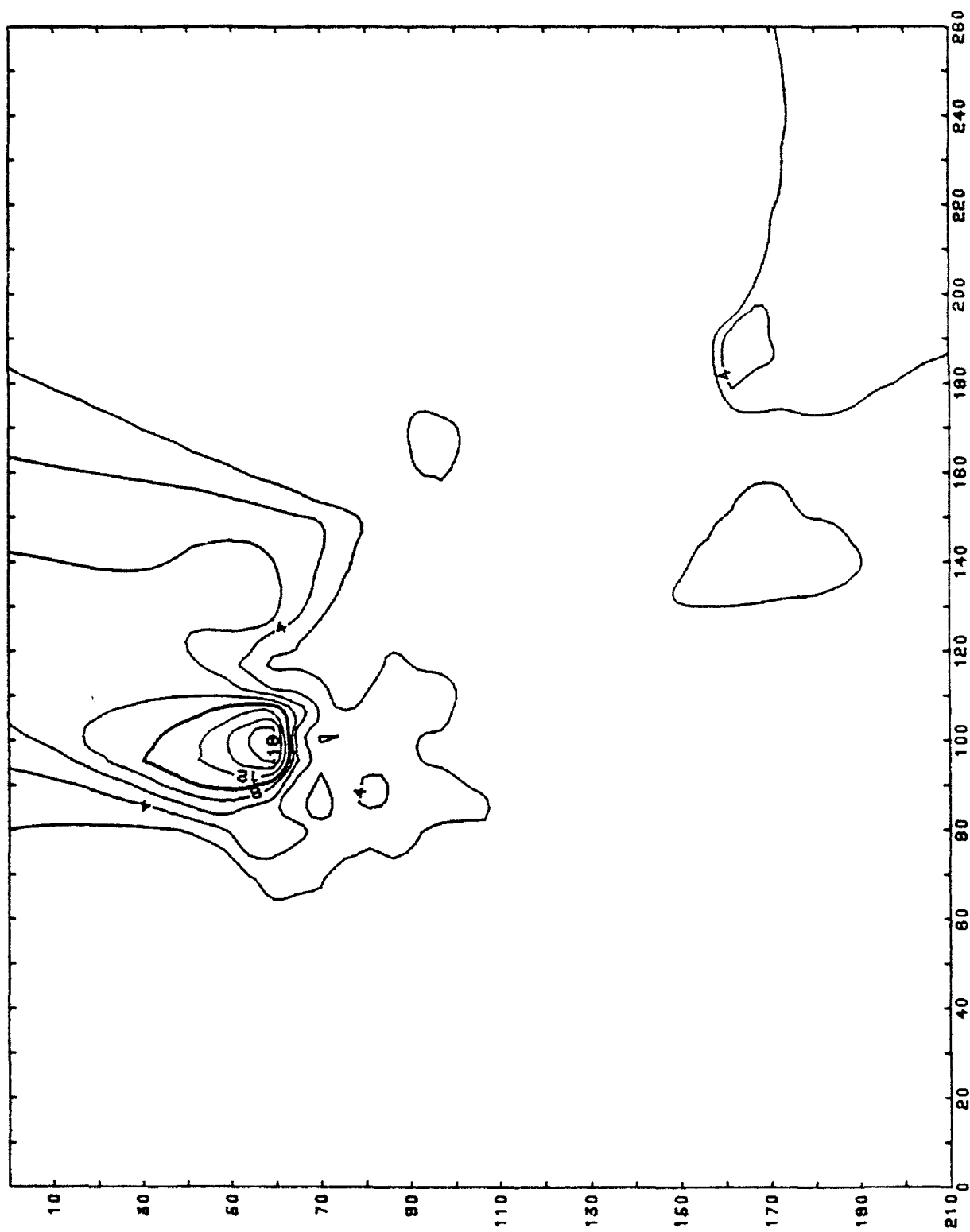


Figure 10-10. Distribution of sand tempered sherds from Level 3 (20-30 cm) at site 3CG847.
Contours interpolated between test pits.

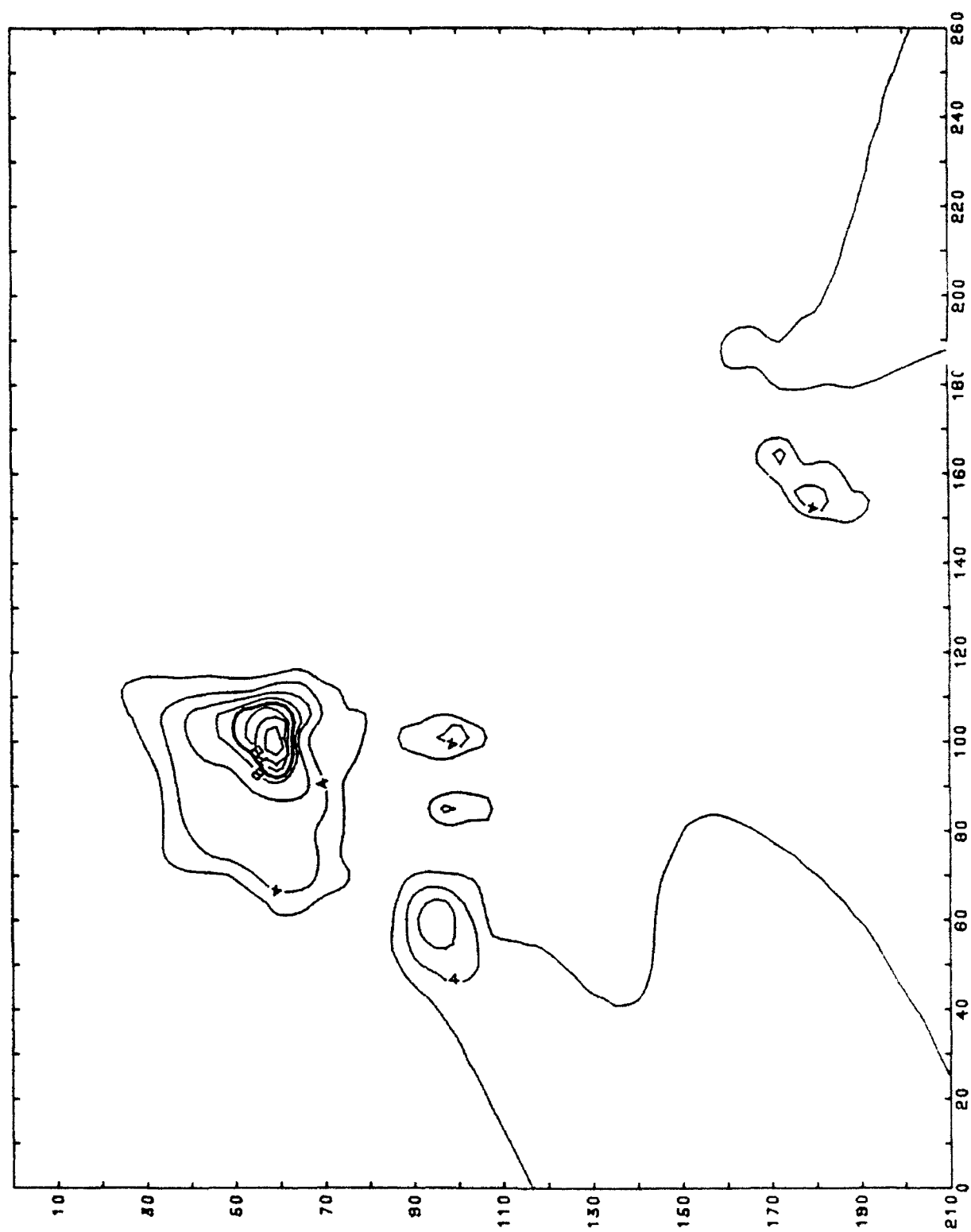


Figure 10-11. Distribution of sand tempered sherds from Level 4 (30-40 cm) at site 3CG847. Contours interpolated between test pits.

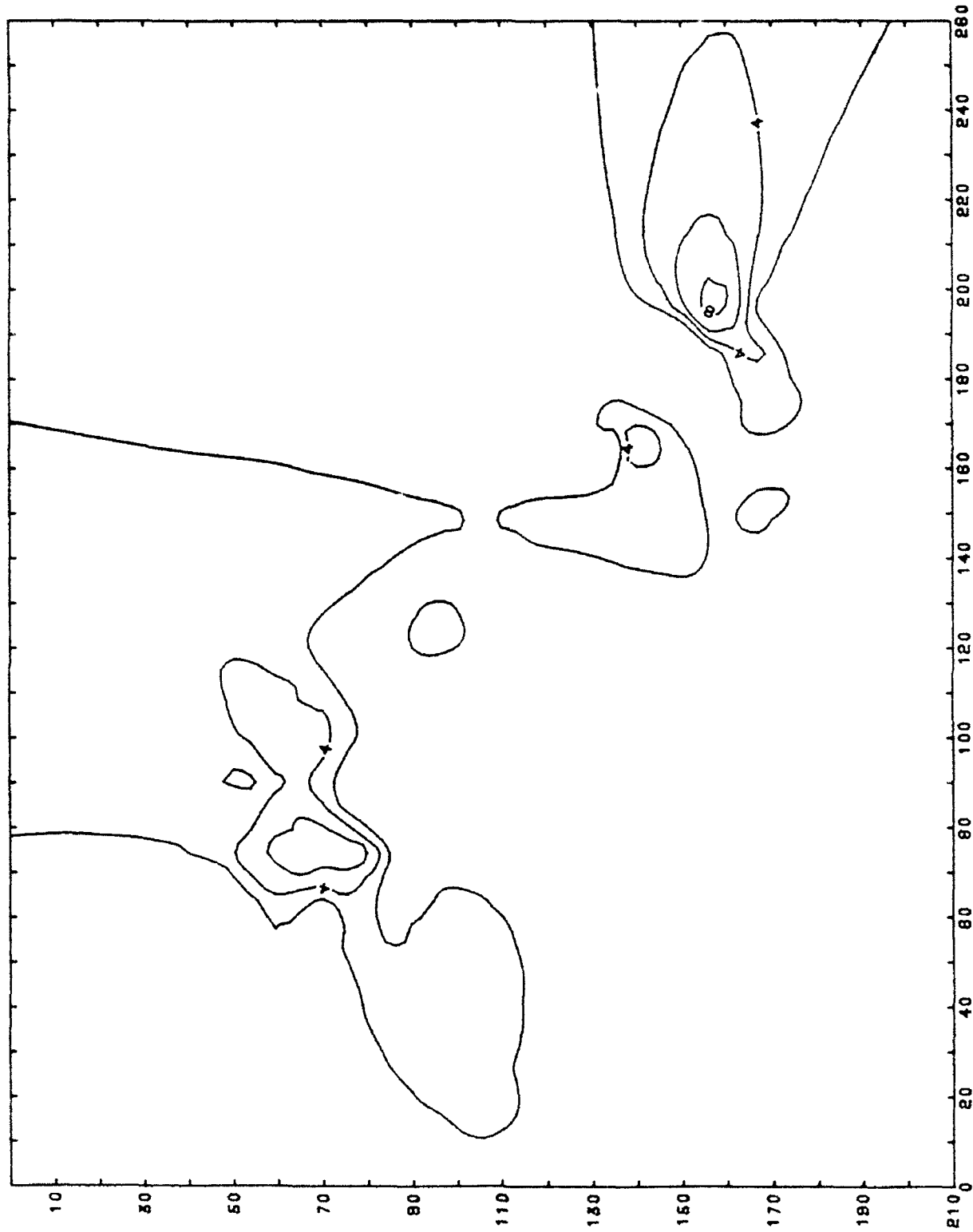


Figure 10-12. Distribution of sand tempered ceramics from Level 5 (40-50 cm) at site 3G847. Contours interpolated between test pits.

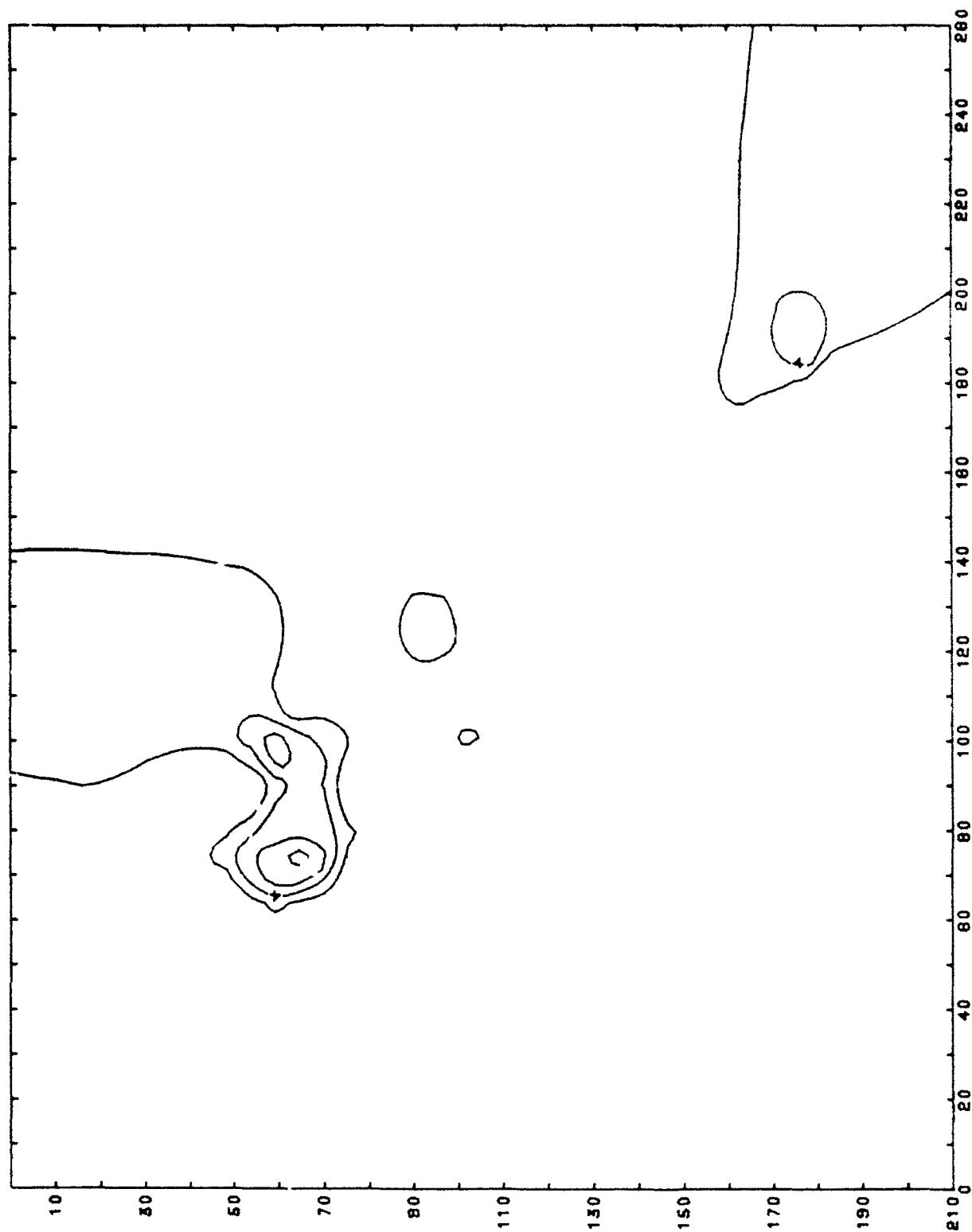


Figure 10-13. Distribution of sand tempered ceramics from Level 6 (50-60 cm) at site 3CG847. Contours interpolated between test pits.

The Late Woodland component is represented by Barnes Cord Marked, var. Barnes (Fig. 10-14). The tempering agent is the same as described for site 3MS346. Probably the most interesting aspect of the ceramic analysis of site 3CG847 is its comparison to site 3MS346 with respect to percentage of cord marked treatment. Three-fourths of the total identifiable Late Woodland (322 of 425) was cord marked on site 3CG847 (Table 10-3). This compares with about one-third of the identifiable sand tempered sherds from site 3MS346.

Based upon the Late Woodland component at Zebree, the percentage of cord marking to plain surface treatment is more like what one would expect for a Barnes occupation. By implication, the percentage of cord marking versus plain between the two sites suggests that site 3MS346 may be a slightly earlier expression of the Late Woodland component. It must be cautioned, however, that there is no other evidence to support this implication. In addition, about 40% of the total ceramic count for site 3CG847 was so eroded that attempts at deriving specific conclusions concerning surface decoration must be limited.

Over stamping of cord marked surfaces was discernable on 23 percent (75) of the total cord marked sherds (Fig. 10-14a). No check stamped sherds were positively identified for the assemblage. Twenty-two rim sherds were counted for the site. All were composed of a Barnes paste. Like site 3MS346, none of these sherds were large enough to approximate vessel size or capacity. Figure 10-14 (b-g) shows the few rimsherds discernable for analysis. All of the rimsherds presented are completely cordmarked on the exterior surface. Rims on specimens d-f tend to thicken slightly on the exterior, producing a fold on specimen d. Although this fold presents an added surface for decoration, it is not decorated. The rim surfaces of all three of these artifacts were also cord marked by a single cord impression. Specimen g is a slightly excurvate rim which is thinned on the interior surface. No rim decorative treatment is noted.

An Early Mississippi component at 3CG847 is represented by 91 sherds. Most of these (72 of 91) were Varney Red Filmed; 18 Neeley's Ferry Plain sherds were present, as was 1 simple stamped sherd. No Early Mississippi rim sherds were recovered. Table 10-3 indicates no vertical separation at the site between the Early Mississippi and Late Woodland components. Although the Early Mississippi sherd count was too small to map effectively, these artifacts were also concentrated in the two dune areas at the site.

Lithics

An examination of the lithic debitage of the site revealed a heavy reliance on Crowley's Ridge chert. No exotic chert was found. A small percentage (11 percent) of the debitage total was quartzite and orthoquartzite, which are available along Crowley's Ridge.

Similar to site 3MS346, the lithic sample is very small for Site 3CG847. The total count of subsurface flakes and shatter is 378, and surface flakes and shatter number only 31 (Table 10-4). In the subsurface collection 218 flakes were counted. The remainder (160) was amorphous shatter. The larger than expected numbers of decortication flakes may indicate that some initial reduction stages of the manufacturing process may have taken place at the site. Nineteen percent of the flakes were primary decortication (full cortex on the dorsal surface), 47 percent were secondary decortication flakes, and only 34 percent were interior flakes with no cortex.

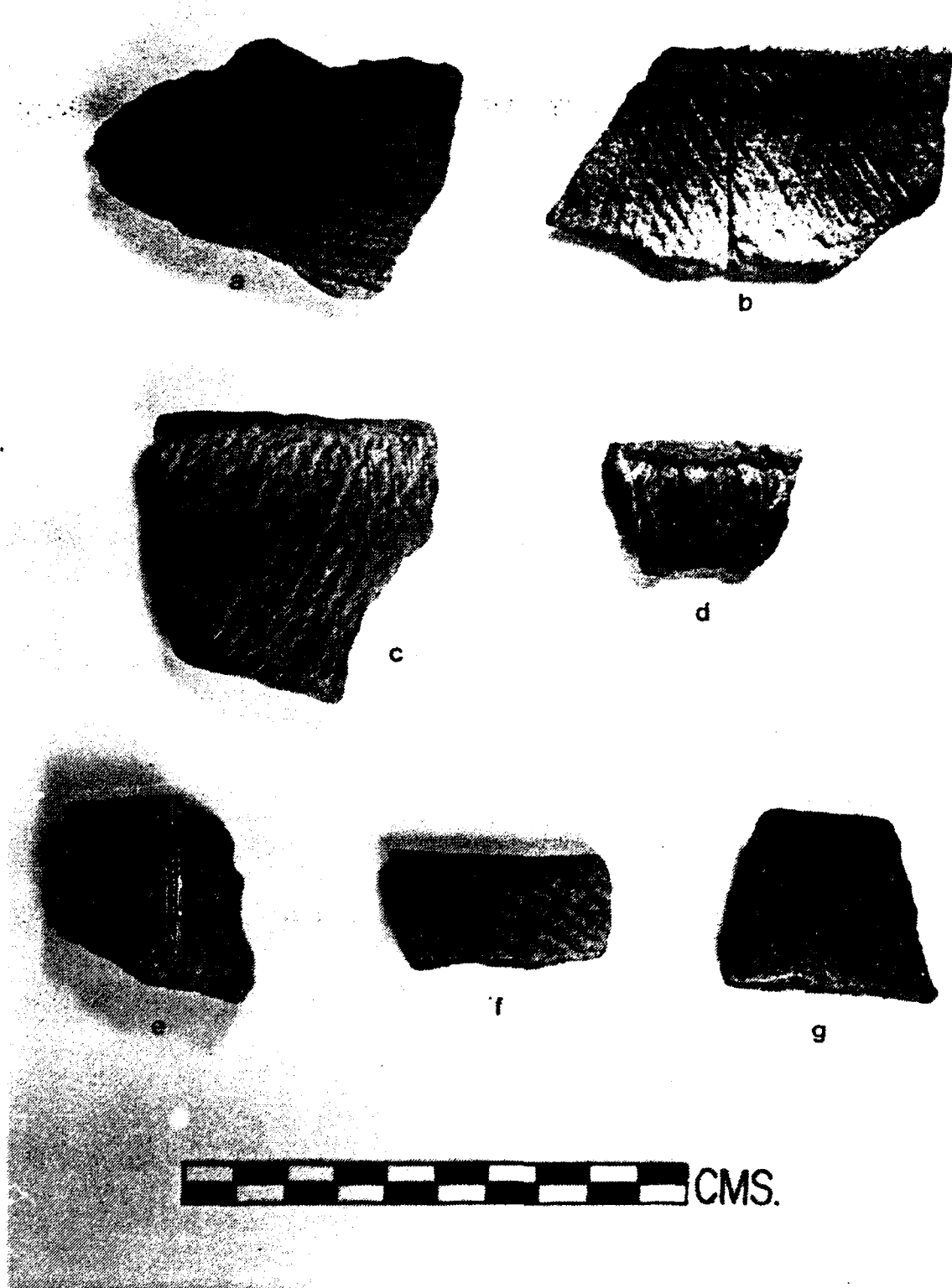


Figure 10-14. Late Woodland ceramics at 3CG847.

TABLE 10-4. LITHIC DEBITAGE FROM 3CG847

	Primary Decortication Flakes	Secondary Decortication Flakes	Interior Flakes	Total Flakes	Utilized Flakes
Surface	4 (13%)	10 (32%)	12 (39%)	26 (84%)	2
Subsurface	41 (11%)	103 (27%)	74 (20%)	218 (58%)	18
	Shatter	Total Pieces	Chert	Quartzite	Orthoquartzite
Surface	5 (16%)	31 (100%)	29 (93%)	1 (3%)	1 (3%)
Subsurface	160 (42%)	378 (100%)	333 (88%)	21 (6%)	24 (6%)

TABLE 10-5. LITHIC TOOLS FROM SITE 3CG847

Catalog Number	Horizontal	Vertical	Type	Time Period	Raw Material
81-1031-414-1	68S/86E	30.02	Point/knife	Late Woodland	Lafayette chert
81-1031-443-21	78S/85E	30.20 (PZ)	Ground stone	Undetermined	Novaculite
81-1031-444-21	78S/85E	30.20 (PZ)	Biface frag.	Undetermined	Chert (var. unspecified)
81-1031-325-21	79S/119E	29.69	Core	Undetermined	Lafayette chert
81-1031-305-6	72S/73E	30.16 (PZ)	Point/knife base	Undetermined	Chert (var. unspecified)
81-1031-899-4	167S/183E	30.40	Spokeshave	Undetermined	Lafayette chert
81-1031-901-21	46S/57E	30.00	Ground stone	Undetermined	Orthoquartzite
81-1031-214-1	140S/70E	Surface	Point	Mississippian	Everton Inter- clastic Bear- ing Chert

(PZ) = plowzone

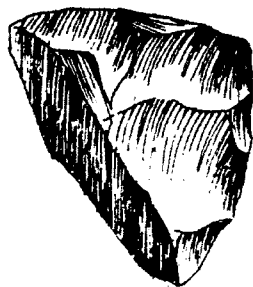
Outside the dune areas (Loci A and B) few lithics were recovered. In these off-dune areas, only 95 pieces of debitage (25 percent of the total subsurface) were located, most of which were in the plow zone. Locus B contained about 15 percent of the total, and Locus A contained about 60 percent.

Eight worked lithic artifacts were recovered over the entire site. Six of these are chipped stone artifacts and two are ground stone. Two bifaces have been classified as to probable type and temporal association, one Late Woodland and one Early Mississippi. Table 10-5 provides the catalog number, type classification, time period, and raw material type for each of the worked lithic artifacts. It is interesting to note that the ratio of chipped stone pieces to debitage at 3CG847 (6 of 378) approximates the also low ratio for 3MS346 (3 of 98).

A single probable Late Woodland biface was identified (Fig. 10-15d) in Locus A. This specimen is interesting because it appears to have been retouched after initial exposure to heat. The majority of this specimen displays the characteristic red coloring, waxy luster, and greasy feeling of heat treated Lafayette gravel. However, pressure flake scars have removed this thermally induced cortex. These scars are characterized by a tannish-brown or yellow coloring commonly found in gravels from Crowley's Ridge. The treatment of the distal end and evidence of resharpener, in addition to the polish and step fracture wear on the working edges, indicate that this specimen probably functioned in other capacities in addition to the traditional functional interpretation as a projectile point. The general form suggests that this specimen belongs to Late Woodland expanded stem cluster (see Volume II).

No other diagnostic Woodland lithic artifacts were recovered. Additional artifacts recovered from excavation of Locus A included a ground novaculite fragment, a broken biface fragment (Fig. 10-15a), an exhausted chert core fragment (Fig. 10-15b), and an unidentifiable base of a bifacial projectile point or knife (Fig. 10-15c). Specimens b and c were found in the plow zone.

A single spokeshave was recovered from excavation of Locus B. The remaining two worked lithics are a ground quartzite fragment located off the dune area in the plow zone west of Locus A, and a projectile point discovered on the surface located off the dune area west of Locus B. The latter specimen is a small point with straight to slightly concave blade edges. It is manufactured on a small flake retaining the platform and a small portion of the bulb of percussion on the proximal base. The shoulders taper to a short, straight stem characterized by a straight base. The distal end is acute. The raw material is Grey Everton Breccia. Lateral blade margins exhibit considerable step fracturing which may be associated with the manufacturing process. This specimen is probably a member of the very small stemmed or notched "dart" or projectile point cluster that is generally dated from approximately 700 A.D. to 1500 A.D. and includes such types as the Scallorn point.



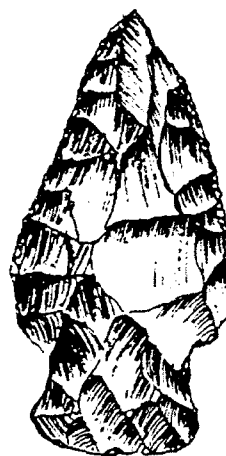
a



b



c



d

Figure 10-15. Lithic artifacts from site 3CG847. a, biface fragment; b, core fragment; c, projectile point base; d, projectile point.

Summary and Interpretations

From a pedological point of view, mapping unit 2 in Figure 10-1 is hypothesized to represent the most suitable area for habitation; mapping unit 1 is rated the worst because it is lower than the surrounding soils and subject to more frequent flooding. Selection of the dune areas for occupation is therefore understandable in terms of drainage characteristics which would offer relative immunity from flooding, provide a probably more productive forest microenvironment in which to live or exploit, and provide more productive agricultural soils.

The cultural remains at site 3CG847 are similar to site 3MS346 to the extent that both sites represent occupations of sand dunes; there is no evidence for occupation prior to the Late Woodland; and both sites are heavily disturbed. This disturbance is evident in the mixing of Late Woodland and Early Mississippi ceramics and the lack of living floors or strata of definite concentration (Table 10-3). The principal destructive effect is thought to be from wind deflation and shifting of the dune sands at the site. In addition, the high acid, porous soils probably destroyed any evidence once present for features and organic remains.

The major occupation represented at site 3CG847 is the Late Woodland (Barnes). Mississippian occupation is represented by less than a hundred ceramics and a single biface similar to the Scallorn projectile point type.

There were no floral or faunal remains recovered at the site, prohibiting a definition of seasonality of occupation. Like site 3MS346, it is difficult, if not impossible, to provide an accurate assessment of the duration of occupation for either component. The only evidence relating to this problem is indirect. The small amount of artifacts suggests a short term occupation.

There is no good basis for determining the size and composition of the social group(s) at the site. Like site 3MS346, no structures are available to determine total living floor area, nor is there enough of a ceramic assemblage to determine vessel counts or size by which the size of the social groups might be approximated.

The occupation of both dune areas on Site 3CG847 may have differed slightly when compared to each other. The evidence is entirely quantitative. As seen in Figures 10-10 to 10-13, Locus A has a greater total ceramic count than Locus B. The fact that the breaking of one or two more ceramic vessels could theoretically account for this difference cannot be ignored, of course. However, as previously noted, 60 percent of the total lithic debris count, as well as most of the very few worked lithics, came from Locus A. This would argue for a slightly more intensive occupation of Locus A than Locus B.

It may be that Locus A was the site of 2-3 Late Woodland houses and Locus B of only one. This is, however, highly speculative. The strong presence of ceramics does indicate that the Late Woodland component is probably a small habitation (domestic) occupation rather than a short term resource exploitation station.

Very little can be said of the nominal Mississippian presence on the site. Again, the presence of ceramics for the Mississippian occupation may indicate a domestic habitation rather than an exploitation camp.

Except for two bifaces (and possibly a third), the very small lithic assemblage at 3CG847 could not be differentiated between the Late Woodland and Early Mississippi components. However, it appears probable that both occupations were very similar in their use of lithic materials. Chert was predominant by far, apparently from the closest source available, Crowley's Ridge. While some limited manufacturing apparently took place at 3CG847, finished tools were highly curated. Only one finished tool was found, and it appears to have been heavily used and reworked.

Site 3CG847 appears very similar in many respects to 3MS346. Both contain Late Woodland and Early Mississippi components. At 3MS346 the Early Mississippi component is more heavily represented, while the reverse is the case for 3CG847. The presence of a higher frequency of cord marking at 3CG847 may indicate a slightly later date for the Late Woodland occupation there, and the higher frequency of Varney Red Filmed over Neeley's Ferry Plain at 3CG847 may indicate a slight time difference between the Early Mississippi components at the two sites.

As discussed above in the summary section for site 3MS346, with such limited collections of data it is difficult to draw inferences that will contribute to ongoing regional research and in particular to the well developed ideas of Morse (Morse and Morse 1980) concerning temporal control and settlement - subsistence modeling for the Dunklin (Barnes) and Big Lake phases. The components at 3CG847 appear to fit Morse's models predicting independent, small homesteads or farmsteads as the most numerous site type. Evidence documenting this functional assignment is limited. Site size is about what might be expected for a 1-3 family homestead. Although evidence for midden, storage pits, hearths, and structures is not present as expected, this might be explained by the soils at 3CG847 and the probable erosion, shifting, and deflation of the dunes sands.

The strong presence of pottery appears to indicate a more intensive, more permanent occupation than would be expected for a resource exploitation station or other special purpose camp. Million (in Morse and Morse 1980: Chapter 16:19) presents estimates of about 1000 sherds for a typical Barnes jar. For the 704 Late Woodland sherds recovered at 3CG847, this would indicate 0.704 jars present in our sample. Since our sample was approximately one percent, this procedure would estimate 70.4 jars broken at 3CG847 over its period of Late Woodland occupation. If bowls or other vessel forms are assumed to account for part of the assemblage, the predicted vessel count would be even larger as these smaller vessels each produce fewer sherds upon breaking.

Even if these numbers are inflated, as Million believes they may be, there is a strong indication that an occupation more substantial than a hunting camp or wild food collecting station was present for the Late Woodland (and similarly for the Early Mississippi) components at 3CG847. We might speculate, following Morse's settlement models, that the component represents a seasonal (summer) habitation, perhaps reoccupied several times.

If this speculation approaches the true situation for the Late Woodland and Early Mississippian components, we might expect a much more substantial lithic assemblage than that recovered. We believe the lack of lithics at 3CG847 (and at 3MS346) is to be explained by a theory of very high curation of lithic raw material and finished tools in this area of northeast Arkansas. This theory will be further developed and applied in our analysis of materials from the Steele site (3MS351) presented in Volume II of this report.